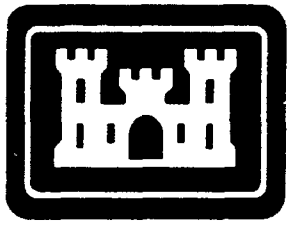

CONTRACT NO. DAAA15-90-D-0014
DELIVERY ORDER NO. 0004

US Army Corps of Engineers

Toxic and Hazardous Materials Agency

COPY 1

FINAL REPORT
ASBESTOS AIR MONITORING RESULTS
AT ELEVEN FAMILY HOUSING AREAS
THROUGHOUT THE UNITED STATES

SUBMITTED TO:

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5401

SUBMITTED BY:

VERSAR, INC.
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MAY 23, 1991

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13. ABSTRACT (Maximum 200 words)
Versar conducted asbestos air monitoring at eleven family housing areas (FHAs) throughout the United States. The objective of the sampling was to evaluate potential air impacts in the family housing units from asbestos containing materials identified in earlier assessments. This evaluation was necessary to clarify the environmental issues prior to sale or realignment of the property. The asbestos air monitoring indicated that three of the FHAs contained no airborne asbestos above the detection limit, and five contained airborne asbestos below the USATHAMA set limit of 0.005 fibers per cubic centimeter (f/cc). Three FHAs contained airborne asbestos at or above 0.005 f/cc, but a statistical test indicated that, in all cases, the indoor air was not statistically different from the outdoor air. No further testing is recommended. No reason was identified to discontinue the use of the FHAs.

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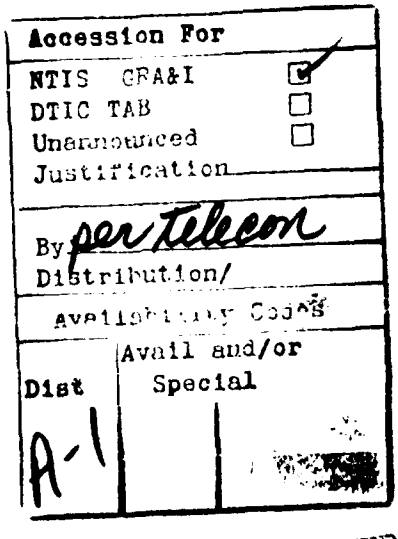

1.0 INTRODUCTION

Versar, Incorporated conducted air monitoring for asbestos at eleven Family Housing Areas (FHAs) located in several states throughout the United States for the United States Army Toxic and Hazardous Materials Agency (USATHAMA). The work was conducted under the Total Environmental Protection Support (TEPS) Contract No. DAAA15-90-D-0014, Delivery Order No. 4 between USATHAMA and Versar.

Previous bulk sample results from 11 FHAs indicated that dust in the ductwork contained asbestos fibers. The presence of asbestos fibers in dust samples appears to confirm earlier speculation that the transite ductwork is the source of asbestos. Previous air sampling was not complete and more information was required to assess the concentration of airborne asbestos and associated health risks. This sampling addresses these questions.

U.S. Army family housing units (FHUs) at eleven FHAs were to be sampled by Versar personnel during January and February 1991. Ten FHAs were sampled in late January and early February. The eleventh FHA (Woodbridge, Virginia) was sampled in late February because a power outage prevented the use of the heating, ventilation, and air conditioning (HVAC) systems.

Versar performed asbestos air monitoring at 10 percent of the FHUs or three FHUs at each FHA, whichever was greater. The criteria used to select the FHUs for sampling were as follows:

- Sample at least one occupied house at each FHA, if occupied units exist.
- Do not sample previously air sampled houses.
- Sample at least one FHU from each construction design (e.g., Capehart, single family, duplex, apartment, and MCA).

Sampling operations were conducted in accordance with TM 5-612 and samples were analyzed using transmission electron microscopy (TEM) according to the Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA) method (Appendix A). Samples of unoccupied houses were collected after the heating systems were allowed to equilibrate (run at least one hour prior to sampling) to ensure conditions were representative of occupied houses. Versar ensured that a minimum volume of 1,200 liters was collected at each of the sample locations and that a flow rate of approximately 10 liters per minute was maintained. The individual sample volumes varied depending on sampling duration, actual flow rate, and temperature correction, if necessary.

A summary of the Quality Assurance Plan for RJ Lee Group, the provider of TEM analysis, is provided in Appendix B. The plan includes key elements as follows: replicate analyses, duplicate analyses, field blanks, lab blanks, analysis of NIST Standard Reference Materials, interlaboratory exchange of samples, participation in NIST and AIHA accreditation programs, participation in the AIHA/NIOSH Proficiency Analytical Testing Program (PAT), thorough analyst training, and careful documented equipment maintenance and calibration. The lab is inspected every two years by NIST, every three years by AIHA and quarterly by the RJ Lee Group QC officer.

The sample detection limits varied depending on sampling volumes and grid openings scanned. Therefore, the detection limits presented in the results summary tables vary from 0.002 fibers per cubic centimeter (f/cc) to 0.005 f/cc.

2.0 ASSESSMENT

Sampling for airborne asbestos fibers was performed at 27 FHUs at 11 FHAs in January 1991 and February 1991. Samples were collected using procedures outlined in Versar's project plan, which was based on the AHERA method and TM5-612. The sampling procedures were designed specifically for USATHAMA with regard to asbestos air monitoring for FHUs. All samples were analyzed by TEM following the protocols specified in AHERA. For each FHA, the floor plans, sampling data sheets, chain of custodies, and analytical results are presented in the Appendix C.

The sampled FHUs were selected on the basis that samples would be collected from at least one house of each construction design, that at least one occupied house at the FHA would be sampled, if occupied units existed, and that the units were not previously air sampled. Air sampling was conducted only after the heating system had been run at least one hour prior to the start of sample collection and while the heating system was operating. This was done to ensure representative air circulation whether the house was occupied or not and be indicative of the worst possible case for exposure of occupants. The designated U.S. Army's Directorate of Engineering and Housing (DEH) was consulted for information related to the representativeness and choice of FHUs to be sampled.

2.1 USARC Addison, Addison, Illinois

Sampling for airborne asbestos fibers was performed at three units of the Addison Army Housing Units on January 29, 1991, by Versar. Ms. Rosann Kryczkowski, a Certified Industrial Hygienist (C.I.H.), and Andris Olmetti, an industrial hygienist (IH), performed the sampling.

2.1.1 Sampling Rationale

Three units were selected by Mrs. O'Connor of Family Housing, with the understanding that at least one unit had to be occupied, and all three were to have the heating systems operating for at least one hour prior to sampling. There are 12 single - family, "Capehart" style housing units located in this development. U.S. Army families reside at this location. The heating systems in the three units were operating prior to air sampling.

2.1.2 Field Activities

The "Capehart" style houses were three bedroom (403 & 404), and two bedroom (410) units. Heat was supplied via forced-air furnaces which were fueled with natural gas. The heating system duct work is embedded in the concrete slab foundation.

Unit 403 was monitored on the morning of January 29, unit 410 was monitored in the afternoon of January 29, and unit 403 was monitored on the morning of January 30. The weather was cold, so each of the units heating systems were operating. The high volume sampling pumps were calibrated before and after sampling using the mini-Buck calibrator which is a primary standard. After the pumps were calibrated, a sampling cassette made of an electrically conductive plastic was attached to the sampling line and placed directly over the heating register to be sampled. The cassette contained a 25 millimeter (mm) diameter mixed cellulose ester (MCE) membrane filter, having a nominal pore size of 0.45 microns (μm). The sampling times were recorded and air sampled for approximately 3 hours.

The pumps were operated for a time period sufficient to draw approximately 1,600 liters of air through each filter based upon presampling calibration values. Following the sampling period, the filter cassettes were removed and capped. Post calibration was conducted and all the necessary information was entered on the label, chain of custody form, and in the field notes.

Two Gillian Aircon 520 pumps were used to collect the two outside air samples and four Abatement Technologies pumps were used to collect the indoor air samples. Pumps were placed so as to collect representative samples over floor registers. Choice of sampling locations was influenced by furniture placement, occupant activities and power source locations. The sampling locations within the units are presented in Table 2.1.1.

2.1.3 Results

The results for the twelve air samples collected in and around units 403, 404, and 410 are presented in Table 2.1.1. No airborne asbestos fibers were detected inside any of the three Addison housing units exceeding the acceptable USATHAMA set limit of 0.005 f/cc. Based on these findings, outdoor samples were not examined. Further air sampling of these units is not required, unless some form of renovation to the heat ducts transpires.

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TABLE 2.1-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS
USARC ADDISON, ILLINOIS
JANUARY 23, 1991
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type Found
UNIT 403	A129-01	Living Room	ND <0.004	
	A129-02	Master Bedroom	ND <0.005	
	A129-03	Bathroom	ND <0.005	
	A129-04	Front Bedroom	ND <0.005	
	A129-05	Outside	Not Analyzed	
	A129-06	Outside	Not Analyzed	
Unit 410	A129-07	Living Room	ND <0.004	
	A129-08	Master Bedroom	ND <0.004	
	A129-09	Bathroom	ND <0.004	
	A129-10	Back Bedroom	ND <0.004	
	A129-11	Outside	Not Analyzed	
	A129-12	Outside	Not Analyzed	
Unit 404	A130-13	Bathroom	ND <0.004	
	A130-14	Living Room	ND <0.004	
	A130-15	Front Room	ND <0.004	
	A130-16	Living Room	0.004*	Chrysotile
	A130-17	Outside	Not Analyzed	
	A130-18	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

*One asbestos fiber (<5.0 um in length) was detected.

2.2 Worth, Illinois

Sampling for airborne asbestos fibers was performed at two units of the Worth Army Housing Units on January 28, 1991, by Versar. Ms.Rosann Kryczkowski, C.I.H., and Mr. Andris Olmetti, an IH, performed the sampling.

2.2.1 Sampling Rationale

Two units were selected by Mrs. O'Connor of the Army Housing Office, with the understanding that at least one unit had to be occupied, and both were to have the heating systems operating for at least one hour prior to sampling. Units 4 and 6 were tested on the survey day.

There are 12 single-family, "Capehart" style housing units located in this development. U.S. Army families reside at this location. The heating systems in both units were operating prior to air sampling.

2.2.2 Field Activities

Both units monitored were three bedroom "Capehart" style houses. Heat was supplied via forced-air-furnaces which were fueled with propane. The heating system duct work is embedded in the concrete slab foundation.

Unit 6 was monitored on the morning of January 28 and Unit 4 was monitored in the afternoon. The weather was cold so both heating systems were operating. The high volume sampling pumps were calibrated before and after sampling using the mini-Buck calibrator which is a primary standard. After the pumps were calibrated, a sampling cassette made of an electrically conductive plastic was attached to the sampling line and placed directly over the heating register to be sampled. The cassette contained a 25mm diameter MCE membrane filter, having a nominal pore size of 0.45um. The sampling times were recorded and air sampled for approximately 3 hours.

The pumps were operated for a time period sufficient to draw approximately 1,600 liters of air through each filter based upon presampling calibration values. Following the sampling period, the filter cassettes were removed and capped. Post calibration was conducted and all the necessary information was entered on the label, chain of custody form, and in the field notes.

Two Gillian Aircon 520 pumps were used to collect the two outside air samples and four Abatement Technologies pumps were used to collect the indoor air samples. Pumps were placed so as to collect representative samples over open floor registers. Choices of sampling locations was influenced by furniture placement, occupant activities and power source location. The sampling locations within the units are presented in Table 2.2.1.

2.2.3 Results

The results for the eight indoor air samples for units 4 and 6 are presented in Table 2.2.1. No airborne asbestos fibers were detected inside in any of the Worth housing units exceeding the acceptable USATHAMA set limit of 0.005 f/cc. Based on these findings outdoor samples were not examined. Further air sampling of these units is not required, unless some form of renovation to the heat ducts transpires.

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TABLE 2.2-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS
WORTH, ILLINOIS
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type Found
UNIT 6	W128-01	Living Room	ND <0.004	
	W128-02	Back Corner Bedroom	ND <0.004	
	W128-03	Master Bedroom	ND <0.004	
	W128-04	Bathroom	ND <0.004	
	W128-05	Outside	Not Analyzed	
	W128-06	Outside	Not Analyzed	
UNIT 4	W128-07	Living Room	ND <0.004	
	W128-08	Rear Corner Bedroom	ND <0.004	
	W128-09	Master Bedroom	ND <0.005	
	W128-10	Bathroom	0.004*	Chrysotile
	W128-11	Outside	Not Analyzed	
	W128-12	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

*One asbestos fiber (<5.0 um in length) was detected.

2.3 Nike NY 54, Holmdel, New Jersey

Sampling for airborne asbestos fibers was performed at three housing units at the Holmdel Army Housing Area, Holmdel, New Jersey on January 31, 1991, by Versar. Messrs. Alton McKissick, CIH and Paul Cestone, IH, performed the sampling.

2.3.1 Sampling Rationale

At the Holmdel FHA all 12 FHUs were of the single family Capehart construction design. Units 206, 207 and 212 were selected for sampling. Units 206 and 207 were occupied and Unit 212 unoccupied.

2.3.2 Field Activities

Prior to conducting air sampling, a visual inspection of the FHUs air conditioning/furnace room and heating and air conditioning ductwork was performed in each FHU sampled. First, the HVAC units themselves were inspected for suspect asbestos-containing materials (ACM). Then, the HVAC registers were removed from each room and the vertical runs to the elbows of the ducts were visually examined for ACM using a high beam flashlight. No sources that were not noted in previous surveys were identified.

FHU 207 was sampled first. FHU 206 was sampled concurrently with FHU 207 with the air pumps being set up immediately after FHU 207's pumps were started. Sampling equipment was warmed to ambient temperature. Four Aircon air pumps were used inside each FHU - one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using Gilibrator Bubble Cell No. 5972-H prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered, the filter cassettes were inverted, capped, and collected. The flow rate of each pump was

measured by the same procedure used prior to the start of sample collection and all data recorded. The equipment was packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. The calculated volumes for the background pumps, which were run outside, were corrected for temperature difference. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.3.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.3.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the asbestos air monitoring results indicate that there is no reason to discontinue the use of the Nike NY 54.

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TABLE 2.3-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NIKE NY 54, HOLMDEL, NEW JERSEY
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 207	68092	Living Room	ND < 0.005	
	68093	Kitchen	ND < 0.005	
	68094	Bed Room	ND < 0.004	
	68095	Bathroom	ND < 0.004	
	68096	Outside	Not Analyzed	
	68097	Outside	Not Analyzed	
Unit 206	68099	Living Room	ND < 0.004	
	68100	Kitchen	ND < 0.004	
	68101	Bedroom	ND < 0.004	
	68102	Bathroom	ND < 0.005	
	68103	Outside	Not Analyzed	
	68104	Outside	Not Analyzed	
Unit 212	68106	Living Room	ND < 0.004	
	68107	Kitchen	ND < 0.004	
	68108	Bedroom	ND < 0.004	
	68109	Bathroom	ND < 0.004	
	68110	Background	Not Analyzed	
	68111	Background	Not Analyzed	

ND = Not Detected at the Limit of Detection.

2.4 Nike NY 60, Old Bridge, New Jersey

Sampling for airborne asbestos fibers was performed at three housing units at the Old Bridge Army Housing Area, Old Bridge, New Jersey on January 29 and 30, 1991, by Versar. Messrs. Alton McKissick, CIH, and Paul Cestone, IH, collected the samples.

2.4.1 Sampling Rationale

At the Old Bridge FHA all 16 FHUs were of the single family Capehart construction design. Units 206, 209 and 212 were selected for sampling. Unit 212 was an occupied unit and units 206 and 209 unoccupied.

2.4.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. No ACM sources that were not noted in previous surveys were identified.

FHU 206 was sampled first. Being unoccupied it had it's heating system set at it's lowest setting, but was not completely deactivated. This meant that the air blower (fan) ran sporadically and infrequently. Therefore, the thermostat was raised to maintain continuous air flow. FHU 209 was sampled concurrently with FHU 212. Air pumps were set up immediately after FHU 206 pumps were started. Sampling equipment was warmed to ambient temperature. Four Aircon air pumps were used inside each FHU, one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using Gilibrator Bubble Cell No. 5972-H, prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered the filter cassettes were inverted, capped, and collected. The flow rate of each pump was

measured by the same procedure used prior to the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. Volumes for the background samples were not corrected for temperature differences since the temperature difference between the inside and outside was between 17 degrees Fahrenheit (°F) to 20°F and the effect on volume was negligible since the accuracy of the pumps is $\pm$ 5 percent. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.4.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.4-1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the asbestos air monitoring results indicate that there is not reason to discontinue the use of Nike NY 60.

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TABLE 2.4-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NIKE NY 60, OLD BRIDGE, NEW JERSEY
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 206	68071	Living Room	ND < 0.003	
	68072	Kitchen	0.003*	Chrysotile
	68073	Bed Room	ND < 0.003	
	68074	Bathroom	ND < 0.003	
	68075	Outside	Not Analyzed	
	68076	Outside	Not Analyzed	
Unit 209	68078	Living Room	ND < 0.004	
	68079	Kitchen	ND < 0.005	
	68080	Bedroom	ND < 0.004	
	68081	Bathroom	ND < 0.004	
	68082	Outside	Not Analyzed	
	68083	Outside	Not Analyzed	
Unit 212	68085	Living Room	ND < 0.005	
	68086	Kitchen	ND < 0.005	
	68087	Bedroom	ND < 0.005	
	68088	Bathroom	ND < 0.005	
	68089	Outside	Not Analyzed	
	68090	Outside	Not Analyzed	

* = One asbestos fiber ($\geq$ 5.0 um in length) was detected.
ND = Not Detected at the Limit of Detection.

2.5 Nike NY 25, Rocky Point, New York

Sampling for airborne asbestos fibers was performed at two housing units at the Rocky Point Army Housing Area, Rocky Pointy, New York on January 28, 1991, by Versar. Messrs Alton McKissick, CIH, and Paul Cestone, IH, collected the samples.

2.5.1 Sampling Rationale

At the Rocky Point FHA all 16 FHUs were of the single family Capehart construction design. Units 5 and 11 were selected for sampling. Both units were occupied; unit 5, a two bedroom Capehart and Unit 11, a three bedroom Capehart.

2.5.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. No ACM sources that were not noted in previous surveys were identified.

FHU 11 was sampled first. FHU 5 was sampled concurrently with FHU 11 with the air pumps being set up immediately after FHU 11's pumps were started. Sampling equipment was warmed to ambient temperature. Four Aircon air pumps were used inside each FHU, one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using, Gilibrator Bubble Cell No. 5972-H, prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered, the filter cassettes were inverted, capped, and collected. The flow rate of each pump was measured by the same procedure used prior to the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. Volumes for the background samples were not corrected for temperature differences since the temperature difference between the inside and outside was between 17°F to 20°F and the effect on volume was negligible since the accuracy of the pumps is ± 5 percent. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.5.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.5.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the asbestos air monitoring results indicate that there is no reason to discontinue the use of Nike NY 25.

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TABLE 2.5-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NIKE NY 25, ROCKY POINT, NEW YORK
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 11	68057	Living Room	ND < 0.002	
	68058	Kitchen	ND < 0.002	
	68059	Bedroom	ND < 0.002	
	68060	Bathroom	ND < 0.002	
	68061	Outside	Not Analyzed	
	68062	Outside	Not Analyzed	
Unit 05	68064	Living Room	ND < 0.003	
	68065	Kitchen	ND < 0.003	
	68066	Bedroom	ND < 0.003	
	68067	Bathroom	ND < 0.003	
	68068	Outside	Not Analyzed	
	68069	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

2.6 Nike NY 99, Spring Valley, New York

Sampling for airborne asbestos fibers was performed at three housing units at the Spring Valley Army Housing Area, Spring Valley, New York on January 25 and 26, 1991, by Versar Inc. Messrs Alton McKissick, CIH, and Paul Cestone, IH, collected the samples

2.6.1 Sampling Rationale

At the Spring Valley FHA all 12 FHUs were of the single family Capehart construction design. Units 203, 207 and 208 were selected for sampling. Unit 203 was an occupied unit and Units 207 and 208 were unoccupied.

2.6.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. Versar did not have the results of previous surveys, but did identify floor tile as a possible ACM. However, the floor tile was in good condition and no samples were collected.

FHU 208 was sampled first. Being unoccupied, the heating system thermostat was set at it's lowest setting, but the HVAC system was not completely deactivated. This meant that the air blower (fan) would run sporadically and infrequently. Therefore the thermostat was raised to maintain continuous air flow. FHU 203 was sampled concurrently with FHU 207 with the air pumps being set up immediately after FHU 203's pumps were started. Sampling equipment was unloaded and the pumps to be used inside were warmed prior to calibration. Background pumps were calibrated at the outside temperature. Therefore, no volume corrections were necessary. Four Aircon air pumps were used inside each FHU, one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were used outside to collect background samples.

The Aircon air pumps were calibrated using, Gilibrator Bubble Cell No. 5972-H, prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered the filter cassettes were inverted, capped, and collected. The flow rate of each pump was measured by the same procedure used prior to the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.6.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM, with results all less than 0.005 f/cc except the bathroom sample from Unit 208, and the field blank and living room samples from Unit 203 (see table 2.6.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater; therefore, the outside samples for Units 203 and 208 were analyzed. All the sample results from Unit 207 were less than 0.005 f/cc. To determine whether the indoor air is impacted from ACM in the FHUs, the indoor air levels were statistically compared to the outside air levels at Units 208 and 203 using the student "t" test (see Appendix D). The test indicated that the indoor air levels are not statistically different from the outdoor levels. At this time, the asbestos air monitoring results indicate that there is no reason to discontinue the use of Nike NY 99.

TABLE 2.6-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NIKE NY 99, SPRING VALLEY, NEW YORK
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 208	68036	Living Room	ND < 0.004	
	68037	Kitchen	0.004[A]	Chrysotile
	68038	Bedroom	0.004[B]	Chrysotile
	68039	Bathroom	0.008[C]	Chrysotile
	68040	Outside	<0.004	
	68041	Outside	<0.004	
Unit 207	68043	Living Room	ND < 0.004	
	68044	Kitchen	ND < 0.005	
	68045	Bedroom	ND < 0.004	
	68046	Bathroom	ND < 0.005	
	68047	Outside	Not Analyzed	
	68048	Outside	Not Analyzed	
Unit 203	68050	Living Room	0.005[A]	Chrysotile
	68051	Kitchen	ND < 0.005	
	68052	Bedroom	ND < 0.005	
	68053	Bathroom	ND < 0.005	
	68054	Outside	ND < 0.004[D]	
	68055	Outside	ND < 0.004[D]	

[A]One fiber less than 5 um in length.
[B]One fiber 5 um or greater in length.
[C]Two fibers less than 5 um in length.
[D]One chrysotile asbestos fiber (>.5- <5 um in length) was identified on the field blank.
ND = Not Detected at the Limit of Detection.

2.7 Nike NY 01, Tappan, New York

Sampling for airborne asbestos fibers was performed at three housing units at the Tappan Army Housing Area, Tappan, New York on January 24, 1991, by Versar. Messrs Alton McKissick, CIH, and Paul Cestone, IH, collected the samples.

2.7.1 Sampling Rationale

At the Tappan FHA all 36 FHUs were of the single family Capehart construction design. Units 402, 403 and 416 were selected for sampling. None of the 36 FHUs were occupied.

2.7.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. No ACM sources that were not noted in previous surveys were identified.

FHUs 402 and 403 were sampled concurrently, and FHU 416 was sampled after FHUs 402 and 403. Being unoccupied, the HVAC thermostats were set at their lowest setting, but the system were not completely deactivated. This meant that the air blower (fan) ran sporadically and infrequently. Therefore the thermostat was raised to maintain continuous air flow. FHU 403 was sampled concurrently with FHU 402 with the air pumps in FHU 403 being set up immediately after FHU 402's pumps were started. Sampling equipment was allowed to reach inside ambient temperatures before calibration. Four Aircon air pumps were used inside each FHU, one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using, Gilibrator Bubble Cell No. 5972-H, prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered the filter cassettes were inverted, capped, and collected. The flow rate of each pump was

measured by the same procedure used prior to the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. The volumes of the background pumps which were run outside were corrected for temperature difference. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.7.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU and, one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.7.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the asbestos air monitoring does not indicate that use of the Nike NY 01 FHA should be discontinued.

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TABLE 2.7-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NIKE NY 01, TAPPAN, NEW YORK
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 402	68015	Living Room	ND < 0.004	
	68016	Kitchen	0.004*	Chrysotile
	68017	Bedroom	ND < 0.004	
	68018	Bathroom	ND < 0.004	
	68019	Outside	Not Analyzed	
	68020	Outside	Not Analyzed	
Unit 403	68022	Living Room	0.004*	Chrysotile
	68023	Kitchen	ND < 0.004	
	68024	Bedroom	ND < 0.004	N/A
	68025	Bathroom	ND < 0.005	N/A
	68026	Outside	Not Analyzed	N/A
	68027	Outside	Not Analyzed	N/A
Unit 416	68029	Living Room	ND < 0.004	
	68030	Kitchen	0.004*	Chrysotile
	68031	Bedroom	ND < 0.004	
	68032	Bathroom	ND < 0.005	
	68033	Outside	Not Analyzed	
	68034	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

*One fiber less than 5 um in length.

2.8 North Smithfield, Slatersville, Rhode Island

Sampling for airborne asbestos fibers was performed at two housing units at the Smithfield Army Housing Area, Slatersville, Rhode Island on January 22, 1991, by Versar. Messrs Alton McKissick, CIH, and Paul Cestone, IH, collected the samples.

2.8.1 Sampling Rationale

At the Slatersville FHA all 16 FHUs were of the single family Capehart construction design. Units 1006 and 1009 were selected for sampling. Unit 1006 was an occupied unit and 1009 unoccupied.

2.8.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. No ACM sources that were not noted in previous surveys were identified.

FHU 1009 was sampled first. Being unoccupied, the heating system thermostat was set at its' lowest setting, but the HVAC system was not completely deactivated. This meant that the air blower (fan) ran sporadically and infrequently. Therefore the thermostat was raised to maintain continuous air flow. FHU 1006 was sampled concurrently with FHU 1009 with the air pumps being set up immediately after FHU 1009's pumps were started. Sampling equipment was allowed to reach ambient temperature before calibration. Four Aircon air pumps were used inside each FHU; one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using Gilibrator Bubble Cell No. 5972-H prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and actual flow rate was measured using the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in it's sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered the filter cassettes were inverted, capped, and collected. The flow rate of each pump was

measured by the same procedure used prior at the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. The calculated volumes for the background pumps, which were run outside, were corrected for temperature difference. The labeled sample cassettes were then packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.8.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.8.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the asbestos air monitoring results indicate that there is no reason to discontinue the use of the Slatersville FHA.

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TABLE 2.8-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
NORTH SMITHFIELD, SLATERSVILLE, RHODE ISLAND
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 1009	68001	Living Room	ND < 0.005	
	68002	Kitchen	ND < 0.005	
	68003	Bedroom	ND < 0.004	
	68004	Bathroom	ND < 0.004	
	68005	Outside	Not Analyzed	
	68006	Outside	Not Analyzed	
Unit 1006	68008	Living Room	ND < 0.004	
	68009	Kitchen	ND < 0.004	
	68010	Bedroom	ND < 0.005	
	68011	Bathroom	0.004*	
	68012	Outside	Not Analyzed	
	68013	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

*One fiber less than 5 um in length.

2.9 Woodbridge, Virginia

Sampling for airborne asbestos fibers was performed at two vacant housing units at the Woodbridge Housing Area, Woodbridge, Virginia on February 27, 1991, by Versar. Messrs Alton McKissick, CIH, and Kevin Foley, IH, collected the samples.

2.9.1 Sampling Rationale

At the Woodbridge FHA both a duplex unit and an apartment were available. Therefore, Unit 14011 (duplex) and Unit 14000 (apartment) were selected for sampling. No units were occupied.

2.9.2 Field Activities

Prior to conducting air sampling, a visual inspection was performed in each FHU sampled. No ACM sources that were not noted in previous surveys were identified.

The HVAC unit for FHU 14000 and FHU 14011 were deactivated. Therefore, the systems were activated and the thermostats raised to maintain continuous air flow. FHU 14000 was sampled concurrently with FHU 14011 with air pumps being set up immediately after FHU 14000's pumps were started. Sampling equipment was allowed to reach inside ambient temperatures before calibration. Four Aircon air pumps were used inside each FHU, one each in the living room, kitchen, a bedroom, and a bathroom. Two Aircon air pumps were also used outside to collect background samples.

The Aircon air pumps were calibrated using Gilibrator Bubble Cell No. 5972-H, prior to each sampling by placing a representative sample cassette in line between the air pump and the Gillian primary standard bubble calibrator. The air pump rotameter was set at ten liters per minute and run against the primary calibrator. The primary calibrator measurement was recorded as the initial flow rate. A 25 mm diameter 0.45 um MCE membrane filter cassette was then attached to the air pump and the unit placed in its sampling location. After all the pumps were calibrated, sample cassettes attached, and the units positioned, a field blank was collected and sampling was begun.

The samples were run for a time sufficient to draw a minimum of 1,800 liters of air though each filter (approximately 3.5 hours). When the necessary air volume was filtered the filter cassettes were inverted, capped, and collected. The flow rate of each pump was measured by the same procedure used prior to the start of sample collection, all data recorded, and the equipment packaged up and removed.

The volume of air drawn through each filter was calculated, based on the average flow rate and the duration of sample collection. The volumes of the background samples that were run outside were corrected for temperature difference. The labeled sample cassettes were packaged with all necessary data and shipped under chain-of-custody to the analyzing laboratory R.J. Lee Group in Manassas, Virginia for TEM analyses using a next day shipping service.

2.9.3 Results

A total of seven samples were collected per FHU. One each from the living room, kitchen, a bedroom, and a bathroom, two background samples collected from outside the FHU, and one field blank. The inside samples and the field blank for all three FHUs sampled were analyzed by TEM with results all less than 0.005 f/cc. (see table 2.9.1). The USATHAMA protocol stipulated these samples be analyzed first, and the outside samples be analyzed only if the inside sample results were 0.005 f/cc or greater. Since all the sample results from this FHA were less than 0.005 f/cc, the outside sample were not analyzed. At this time, the air monitoring results indicate that there is no reason to discontinue use of the Woodbridge FHA.

Versar INC.

TABLE 2.9-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING & ANALYSIS
WOODBRIDGE, VIRGINIA
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type
Unit 14000	77142	Living Room	ND < 0.005	
	77143	Kitchen	ND < 0.005	
	77144	Bedroom	ND < 0.005	
	77145	Bathroom	ND < 0.005	
	77146	Outside	Not Analyzed	
	77147	Outside	Not Analyzed	
Unit 14011	77133	Living Room	ND < 0.004	
	77134	Kitchen	ND < 0.005	
	77135	Bedroom	ND < 0.005	
	77136	Bathroom	ND < 0.005	
	77137	Outside	Not Analyzed	
	77138	Outside	Not Analyzed	

ND = Not Detected at the Limit of Detection.

2.10 Midway Nike Manor, Kent, Washington

Sampling for airborne asbestos fibers was performed at two units of the Midway Army Housing Units on January 24, 1991, by Versar. Ms. Rosann Kryczkowski, a CIH, and Mr. Andris Olmetti, an IH, collected the air samples.

2.10.1 Sampling Rationale

Two units were selected by the King County Housing Authority (Mr. Joe Thomas) with the understanding that at least one had to be occupied, and both were to have the heating systems operating for at least one hour prior to sampling. Upon arrival, the complex managers, Mr. and Mrs. Lawson, indicated a change in units to be monitored because of availability of occupants. In addition, they requested that unit No. 3, which had a fire, be visually checked.

Both units selected, No. M1 and No. M18, were being used by the Mental Health Center. Unit M1 was being used for storage and additional office space, and unit M18 was being used by staff members as office space. The tested units were next door to each other. Heating systems in both units were operating prior to testing.

2.10.2 Field Activities

This housing project is currently being leased to three groups and occupied as follows:

King County Emergency Shelter - 15 units
Highline/West Seattle Mental Health Center - 6 units
Catholic Community Charities - 8 units
Managers' Residence - 1 unit

All of the units were three bedroom "Capehart" style houses. Heat was supplied via forced-air furnaces which were fueled with oil.

A visual inspection of unit M3 was conducted at the request of the complex managers as it had been involved in a fire and there was damage to the structure. Most of the damage appeared to be to the outside front of the house and the roof. Previous surveys indicate the siding contains asbestos, and repair of fire damaged areas is appropriate.

Unit M16 had recently been demolished as a result of a fire. Demolition debris was still present where the house once stood. It was possible to see the heating system duct work in the concrete pieces.

Both units, M1 and M18, were sampled on January 24; M1 in the morning and M18 in the afternoon. The weather was cold so both heating systems were operating. The high volume sampling pumps were calibrated before and after sampling using the mini-Buck calibrator which is a primary standard. After the pumps were calibrated, a sampling cassette made of an electrically conductive plastic was attached to the sampling line and placed directly over the heating register to be sampled. The cassette contained a 25mm diameter MCE membrane filter, having a nominal pore size of 0.45um. The sampling times were recorded and air sampled for approximately 3 hours.

The pumps were operated for a time period sufficient to draw approximately 1,600 liters of air through each filter based upon presampling calibration values. Following the sampling period, the filter cassettes were removed and capped. Post calibration was conducted and all the necessary information was entered on the label, chain of custody form, and in the field notes.

Two Gillian Aircon 520 pumps were used to collect the two outside air samples and four Abatement Technologies pumps were used to collect the indoor air samples. Pumps were placed so as to collect representative samples over open floor registers. Choice of sampling locations was influenced by furniture placement, occupant activities and power source locations. Sampling locations for M1 and M18 were as follows:

M1	M18
Front Bedroom	Side Bedroom
Back Bedroom	Back Bedroom
Living Room-rear window	Living Room-rear window
Kitchen	Living Room-front window
Outside-rear	Outside-rear
Outside-front	Outside-front

2.10.3 Results

The results for the six air samples collected in and around unit M1 and the four inside air samples from unit M18 are presented in Table 2.10.1. The two outside samples from unit M1 were analyzed since chrysotile was detected in one of the inside air samples collected in

the back bedroom (M-124-14). The analytical result for that sample of 0.005 f/cc equals the acceptable limit set by USATHAMA. It should be noted that the analytical result for the outside air sample collected at the rear of the house was 0.010 f/cc with both chrysotile and actinolite being detected. There was no apparent visible damage to this unit either inside or outside. The field blank was analyzed and no asbestos was detected. Only one inside sample was positive and it was at the limit set by USATHAMA, and close to the detection limit. To determine whether the indoor air is impacted by ACM in Unit M1, the indoor air levels were statistically compared to the outside air levels using the student "t" test (see Appendix D). The test indicated that the indoor air levels are not statistically different from the outdoor levels.

All of the indoor air samples for unit M18 were found to be below the detection limits of 0.004 and 0.005. Therefore, the outside air samples were not analyzed.

At this time, the asbestos air monitoring results do not indicate that use of this FHA should be discontinued.

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TABLE 2.10-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS
MIDWAY NIKE MANOR, KENT, WASHINGTON
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type Found
Unit M1	M-124-13	Front Bedroom	<0.005	
	M-124-14	Back Bedroom	0.005[A]	Chrysotile
	M-124-15	Living Room-rear	<0.005	
	M-124-16	Kitchen	<0.005	
	M-124-17	Outside-rear	0.010[B]	Chrysotile/Actinolite
	M-124-18	Outside-front	<0.005	
Unit M18	M-124-19	Side Bedroom	<0.004	
	M-124-20	Back Bedroom	<0.005	
	M-124-21	Living Room-rear	<0.005	
	M-124-22	Living Room-front	<0.004	
	M-124-23	Outside-rear	Not Analyzed	
	M-124-24	Outside-front	Not Analyzed	

[A]One fiber less than 5 um.
[B]One fiber less than 5 um and one fiber at 5 um or greater.

ND = None Detected at the limit of detection cited.

2.11 Youngs Lake, Renton, Washington

Sampling for airborne asbestos fibers was performed at two units of the Youngs Lake Army Housing Units on January 23, 1991, by Versar. Ms. Rosann Kryczkowski, a CIH, and Mr. Andris Olmetti, an IH, collected the air samples. The results from one sample were suspect; therefore, verification sampling was performed on April 3 and 4, 1991, by Alton McKissick, a CIH and Kevin Foley, an asbestos monitoring specialist, IH.

2.11.1 Sampling Rationale

Two units were selected by CPO Penn of the Coast Guard, with the understanding that at least one unit had to be occupied, and both were to have the heating systems operating for at least one hour prior to sampling. Upon arrival at the first unit chosen, unit L-25, the tenant informed us that she was not expecting us, and her heating system had not been functional for many hours. CPO Penn was contacted and identified unit L-24 as the intended unit for morning sampling. Units L-24 and L-19 were tested on January 23. Unit L-24 was sampled again on April 3 and 4.

There are 28 single-family, "Capehart" style housing units located in this development. Both Marine and Coast Guard families are located here. The heating systems in both units were operating prior to air sampling.

2.11.2 Field Activities

Both units monitored were three bedroom "Capehart" style houses. Heat is supplied via forced-air furnaces which are fueled with oil. The heating system duct work is embedded in the concrete slab foundation.

Unit L-24 was monitored on the morning of January 23 and Unit L-19 was monitored in the afternoon. The weather was cold so both heating systems were operating. The high volume sampling pumps were calibrated before and after sampling using a mini-Buck calibrator which is a primary standard. After the pumps were calibrated, a sampling cassette made of an electrically conductive plastic was attached to the sampling line and placed directly over the heating register to be sampled. The cassette contained a 25mm diameter mixed cellulose ester membrane filter (MCEF), having a nominal pore size of 0.45um. The sampling times were recorded and air sampled for approximately 3 hours.

The pumps were operated for a time period sufficient to draw approximately 1,600 liters of air through each filter based upon presampling calibration values. Following the

sampling period, the filter cassettes were removed and capped. Post calibration was conducted and all the necessary information was entered on the label, chain of custody form, and in the field notes.

Two Gillian Aircon 520 pumps were used to collect the two outside air samples and four Abatement Technologies pumps were used to collect the indoor air samples. Pumps were placed so as to collect representative samples over open floor registers. Choice of sampling locations was influenced by furniture placement, occupant activities and power source locations. Sampling locations for L-24 and L-19 were as follows:

L-24	L-19
Living Room-rear window	Back Corner Bedroom
Inside near side door	Inside near side door
Back Center Bedroom	Living Room-rear window
Front Bedroom	Front Hall
Outside-rear	Outside-carport side
Outside-carport side	Outside-carport side

On April 3 and 4, 1991, the front bedroom air duct was visually examined below the register and ambient air samples were collected in the front bedroom and the living room for subsequent asbestos analysis by TEM. The heating/air conditioning (HVAC) register in the front bedroom was removed and the assessable portion of the duct was visually examined with a high beam flashlight. There was no evidence of dust/dirt accumulation.

Ambient air samples were collected Wednesday afternoon (April 3) and Thursday morning (April 4). Two samples from the front bedroom and one sample from the living room were collected, along with a field blank, each sampling period. Procedures and materials duplicated outlined sampling efforts on January 23, 1991, except a greater volume of air was collected to allow a greater sensitivity.

2.11.3 Results

The results for the six air samples collected in and around unit L-24 and the four inside air samples from unit L-19 are presented in Table 2.11.1. The results for the four inside air samples collected in unit L-19 were below the detection limits of 0.004 or 0.005 f/cc. Therefore, the outside air samples were not analyzed. The two outside samples from unit L-24 were analyzed, since chrysotile was detected in one of the inside air samples which was collected in the front bedroom (Y-123-4). To determine whether the inside air is impacted

by ACM in Unit L-24, the inside levels were statistically compared to the outside levels using the student "t" test (see Appendix D). The test indicated that the indoor levels were not statistically different from the outside levels.

The analytical result of 0.021 f/cc for the front bedroom sample from unit L-24 exceeded the acceptable limit of 0.005 f/cc set by USATHAMA. This result also exceeds the limit of 0.01 f/cc quoted by the EPA as being acceptable following asbestos abatement activities. Although the fibers detected were less than 5 microns in length, the health issues regarding the size fiber are still in debate. Additionally, the fiber level was four times greater than the acceptable limit set by USATHAMA. Therefore, a follow-up survey of this unit was conducted. During the April 3 and 4 sampling, there were no airborne asbestos fibers found even though the detection limit was lowered to 0.003 f/cc. Table 2.11-2 presents this data.

At this time, the asbestos air monitoring results indicate there is not reason to discontinue use of the Youngs Lake FHA. No further testing is necessary.

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TABLE 2.11-1. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS
YOUNGS LAKE, RENTON, WASHINGTON
JANUARY 23, 1991
(ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Location	Asbestos Concentration	Asbestos Type Found
Unit L-24	Y-123-1	Living Room-Rear	<0.005	
	Y-123-2	Inside (Near Sidedoor)	<0.004	
	Y-123-3	Center Bedroom (Back)	<0.004	
	Y-123-4	Front Bedroom	0.021*	Chrysotile
	Y-123-5	Outside (Rear of house)	<0.004	
	Y-123-6	Outside (Front of house)	<0.004	
Unit L-19	Y-123-7	Back Corner Bedroom	<0.005	
	Y-123-8	Inside, Sidewall	<0.005	
	Y-123-9	Living Rm (Rear window)	<0.004	
	Y-123-10	Front Hall	<0.004	
	Y-123-11	Outside Front of house	Not Analyzed	
	Y-123-12	Outside Side of house	Not Analyzed	

ND = Not Detected at the Limit of Detection.

* = All fiber less than 5.0 microns in length.

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TABLE 2.11-2. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS YOUNGS LAKE, RENTON, WASHINGTON, APRIL 3-4, 1991 (ALL VALUES IN FIBERS/CC)

House	Sample Number	Sample Date	Sample Location	Asbestos Concentration	Asbestos Type Found
Unit L-24	77150	04/03/91	Front Bedroom	ND <0.003	
	77151	04/03/91	Front Bedroom	ND <0.003	
	77152	04/03/91	Living Bedroom	ND <0.003	
Unit L-24	77153	04/04/91	Front Bedroom	ND <0.003	
	77154	04/04/91	Front Bedroom	ND <0.003	
	77155	04/04/91	Living Bedroom	ND <0.003	

ND = None Detected at the limit of detection

3.0 SUMMARY

Versar has conducted air monitoring for asbestos at 11 FHAs in accordance with the US THAMA purchase request THAMA019910078, Contract No. DAAA15-90-D-0014, Delivery Order No. 4. From these FHAs, 27 housing units were sampled.

Air samples were drawn through a 0.45 micron MCE filter and the sampling data recorded on sampling data sheets (Appendix C). Labeled sample cassette with all necessary data were sent under chain-of-custody (Appendix C) to the analyzing laboratory, R.J. Lee Group, Manassas, Virginia. The samples were analyzed by TEM and the results sent to Versar (Appendix C).

Three of the FHAs sampled contained no airborne asbestos above the detection limit:

- Nike NY 54, Holmdel, New Jersey (3 units sampled);
- Nike NY 25, Rocky Point, New York (2 units sampled); and
- Woodbridge, Virginia (2 units sampled).

Five of the FHAs sampled contained no airborne asbestos at or above the USATHAMA set limit of 0.005 f/cc:

- USARC Addison, Illinois (3 units sampled, 1 detection below 0.005 f/cc at 1 unit);
- Worth, Illinois (2 units sampled, 1 detection below 0.005 f/cc at 1 unit);
- Nike NY 60, Old Bridge, New Jersey (3 units sampled, 1 detection below 0.005 f/cc at 1 unit);
- Nike NY 01, Tappan, New York (3 units sampled, 1 detection below 0.005 f/cc at each unit); and
- North Smithfield, Slatersville, Rhode Island (2 units sampled, 1 detection below 0.003 f/cc at 1 unit).

At four out of seven FHUs at three FHAs, airborne asbestos was detected at or greater than the USATHAMA set limit of 0.005 f/cc:

- Nike NY 99, Spring Valley, New York (2 units out of the 3 sampled had levels at or greater than 0.005 f/cc);

- Midway Nike Manor, Kent, Washington (1 unit out of the 2 sampled had levels at or greater than 0.005 f/cc); and

- Youngs Lake, Renton, Washington (1 unit out of the 2 sampled had levels at or greater than 0.005 f/cc).

To determine whether the indoor air was impacted by ACM in the FHUs, the indoor levels were statistically compared to the outdoor levels using the student "t" test (see Appendix D). The test indicated that, in all cases, the indoor air was not statistically different from the outdoor air.

However, only unit L-24 at Youngs Lake Army Housing unit produced enough airborne asbestos (0.021 f/cc, chrysotile) to warrant additional air monitoring to ensure the occupants were not exposed to unacceptable limits of airborne asbestos. The resampling at unit L-24 revealed no airborne asbestos fibers. In addition, an outside sample of unit M1 at Midway Army Housing Area gave 0.01 f/cc, chrysotile/actinolite. This may be due to fire damage to unit M3 and debris from unit M16.

No further testing is recommended, unless some form of renovation transpires at the FHAs. No reason was identified not to continue using these housing units.

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APPENDIX A
AHERA TRANSMISSION ELECTRON MICROSCOPY (TEM) METHOD

GUIDANCE FOR CONTROLLING ASBESTOS-CONTAINING MATERIALS IN BUILDINGS

1985 EDITION

Exposure Evaluation Division
Office of Toxic Substances
Office of Pesticides and Toxic Substances
U.S. Environmental Protection Agency
Washington, D.C. 20460

and the plastic sheets covering doors, vents, and windows should be left in place until the air test has been passed.) If a negative air pressure ventilation system was used during abatement, it should continue operating while air monitoring is in progress.

As discussed in Section 4.1, measuring airborne asbestos fibers accurately is technically complex and usually expensive. It involves two steps: air sampling to capture fibers on a filter, and laboratory analysis to determine the quantity of asbestos. There are several approaches to air sampling and analysis, varying in technical requirements, cost, and availability. Which approach is more appropriate is a controversial subject. The information presented in the remainder of this chapter is based in part on a 1984 workshop sponsored by EPA and the National Bureau of Standards. A companion EPA guidance document on air monitoring following an abatement action discusses the subject in more detail (USEPA 1985b).

6.4.2.1 Sampling

Sampling for asbestos consists of collecting fibers by drawing air through a filter at a known rate. Usually, sampling equipment is placed at a fixed location for a certain period of time. But this approach may fail to detect the presence of fibers. For example, if sampling is conducted for a short time during a quiet period (i.e., when air movement is limited), many fibers will settle out of the air onto the floor and other surfaces and may not be captured on the filter. Under these conditions, air measurements could show little or no asbestos.

Previously, EPA recommended sampling for at least eight hours to cover various air circulation conditions and thus increase the likelihood of capturing asbestos fibers if they are present. A quicker and more effective way to accomplish this, however, is to circulate the air artificially so that the fibers remain airborne during sampling.

This "aggressive sampling" is recommended for the post-abatement air test. Recommended methods for conducting aggressive sampling are presented in Appendix M. They use forced-air equipment such as a leaf blower to dislodge free fibers, then slow-speed fans to keep the fibers suspended during sampling.

Persons who conduct the sampling should wear a respirator. Even though the work site has been cleaned and has passed the visual test, levels of airborne asbestos still may be elevated.

6.4.2.2 Analysis of Samples

Three microscopic methods are currently being used to analyze asbestos: phase contrast microscopy (PCM), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). The characteristics and relative merits of each method are summarized in Table 5 and are described in detail in the companion EPA guidance document (USEPA 1985b).

As indicated in Table 5, PCM is the method that is most familiar, available, and frequently used. It is also the least expensive and has a well-established analytical protocol. (As noted in Section 4.1.2, OSHA specifies PCM for monitoring worker exposure in asbestos industries.) However, the NIOSH protocol for PCM does not distinguish between asbestos and other types of fibers and counts only fibers longer than 5 micrometers. Nor is PCM sensitive enough to detect the extremely thin fibers typical of airborne asbestos in buildings. Thus, the interpretation of PCM results assumes that a low concentration of relatively large airborne fibers means that the concentration of asbestos fibers is also low.

The TEM method gives the most complete information on airborne asbestos: it can distinguish asbestos from other fibers and also is able to detect very thin fibers. However, it can be expensive and time-consuming. TEM is not widely available.

TABLE 5. COMPARISON OF METHODS FOR MEASURING AIRBORNE ASBESTOS

	PCM	SEM	TEM
Standard Methods	NIOSH P&CAM 239 Method.[1]	No standard method.	EPA provisional method & update.[2]
Quality Assurance	Proficiency Analytical Testing Program; no NBS[3] reference materials.	No lab testing, or NBS reference materials.	Limited lab testing; NBS reference materials available.
Cost	$25-50	$50-300	$200-600
Availability	Most available.	Less available.	Least available.
Time Requirements	1 hr. preparation & analysis, < 6 hrs. turnaround.	4 hrs. preparation & analysis, 6-24 hrs. turnaround.	4-24 hrs. preparation & analysis, 2-7 days turnaround.
Sensitivity (Thinnest Fiber Visible)	0.15 μm at best; 0.25 μm typical.	0.05 μm at best; 0.20 μm typical.	0.0002 μm at best; 0.0025 μm typical.
Specificity	Not specific for asbestos.	More specific than PCM but not definitive for asbestos.	Definitive for asbestos. when used to its fullest capabilities.

[1] NIOSH 1979. The new NIOSH 7400 method is an alternative.
[2] USEPA 1977, Yamate 1984.
[3] National Bureau of Standards.

Source: Taken with modification from USEPA 1985b.

The SEM method can be somewhat more specific for asbestos and more sensitive to thin fibers than PCM, but less so than TEM. It is also less expensive and time-consuming than TEM. At present, however, no standard measurement protocol is available for SEM. As a result, it has not been systematically evaluated nor has the reliability of SEM measurements been established.

EPA acknowledges that all three methods are used in air testing for the purpose of releasing abatement contractors. However, only PCM and TEM have standard methods and testing programs. A standard method has not yet been developed for SEM. While TEM is technically the method of choice, PCM is the only option in many localities.

6.4.2.3 Recommended Test Specifications

Regardless of the microscopic method for measuring asbestos, identifying homogeneous work sites is the first important step in the process. A site within the abatement work area is homogeneous if it contains one type of ACM and only one type of abatement was used. For sampling purposes, the air in each

homogeneous site is assumed to be relatively uniform. Guidelines for locating the samplers are included in Appendix M. Several other aspects of the air test are identical, regardless of microscopic method:

- Choose sampling locations within the homogeneous work site to assure representative samples. (See Appendix M).
- Begin sampling when the work site is dry (24 hours after cleaning).
- Conduct aggressive air sampling in all cases.
- Follow sampling and analysis specifications, including procedures for quality control.

The asbestos program manager should be sure the technical advisor in charge of the air test knows the specifications listed below. The advisor should insist that recommended procedures be followed for both air sampling and laboratory analysis.

Testing with the TEM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples in each homogeneous work site.
- At the same time, collect at least five samples just outside the work site but within the building. These samples will be compared with those collected inside the work site to ensure that the work site is at least as clean as the incoming air (see Appendix M for details).[1]

Analysis:

- Measure the asbestos on each filter with TEM using the EPA provisional procedures and updates (USEPA 1977 and Yamate 1984).
- Use a direct transfer method of sample preparation if possible (see Appendix M).
- Express the results as f/cc, or as ng/m^3 if an indirect sample preparation is used.
- Include at least one field blank [2] and one laboratory blank per abatement job for quality control purposes (see Section 6.4.3). Also, split one work site sample and conduct duplicate analyses.

Release Criterion:

- Release the contractor if the average fiber concentration of the work site samples is not statistically larger than the average of the outside samples. Each homogeneous site must pass the test before the contractor is released. (Appendix M contains information to determine statistical differences.)
- If the average of the work site samples is statistically larger than the average of the outside samples, clean the entire work site again and repeat the test (collect new work site samples and follow the procedures described above).

[1] If a negative pressure system has not been used, collect the "outside" samples outdoors.

[2] A blank is a filter that is not used for sampling but is otherwise treated in the same way as other filters.

Testing with the PCM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples per homogeneous work site, or one per room, whichever is greater.

Analysis:

- Measure the asbestos on each filter with PCM using the NIOSH P&CAM 239 procedures. (The newer NIOSH 7400 procedures can also be used. See Appendix M.)
- Include at least one field blank and one laboratory blank per abatement project, for quality control purposes. Also, split one work site sample for duplicate analysis.

Release Criterion:

- Release the contractor if every sample value is below the limit of reliable quantification (approximately 0.01 f/cc when 3000 liters of air are sampled; see Appendix M).
- If any of the sample values is above the prescribed level, clean the entire work site again, collect new samples, and evaluate the samples as described above.

For each method, the recommended number of samples and the prescribed use of the data defining the release criteria are based on a compromise involving practical considerations of cost, time required for the tests, performance characteristics of the methods, and statistical criteria. Details of the sampling and analysis specifications are provided in Appendix M.

6.4.3 Quality Assurance

Notwithstanding the advantages of one microscopic method over another, no method will produce reliable results unless both the field sampling and laborabory analysis are properly conducted. To obtain reliable results, a quality assurance (QA) program for the collection and analysis of data is essential.

The objective is to produce measurements with sufficient and documented quality for their intended purpose. In this case, the purpose is to determine satisfactory completion of an abatement project. The components of a QA program range from clerical activities such as labeling samples and documenting results, to performing technically complex tasks in the laboratory. When establishing the quality of data, however, all activities are equally important.

Preparing and implementing a QA program requires the assistance of a technical advisor on asbestos measurement. EPA and OSHA have published guidelines on quality assurance for TEM and PCM (Yamate 1984, and NIOSH 1979). The QA Program Checklist below can be used by the asbestos program manager in reviewing a proposed QA program.

QA Program Checklist

- **Training and Experience:** Be sure that all persons producing the measurement understand their roles and are trained. Select a laboratory with demonstrated proficiency in asbestos analysis. Request details of the laboratory's quality control program, and get documentation of the lowest level of fibers routinely reported.

- **Quality Control Checks:** Use field and laboratory blanks to check for fiber contamination, coded sample labels to avoid analyst bias, duplicate analyses to confirm precision, and a second laboratory to spot-check the accuracy of results.

- **Chain-of-Custody:** Assign responsibility for security of the samples to specific persons at each stage of the analysis. Document each step in the passage of the sample from the field to the laboratory.

- **Documentation:** Check and document laboratory results as well as their labeling. The building owner should retain all test results and records documenting the testing process.

Appendix M. Detailed Specifications for Sampling and Analyzing Airborne Asbestos

The following specifications are summarized from "Measuring Airborne Asbestos Following an Abatement Action" (USEPA 1985).

M.1 Sampling

M.1.1 Sampling Equipment

Standard sampling equipment consists of a pump (operated at a 2 to 12 liter per minute flow rate), a filter in a cassette and associated tubing and supports. Three types of filters can be used:

PCM — cellulose ester with 0.8 to 1.2 μm pore size;

TEM — polycarbonate with 0.4 μm pore size (preferred); or cellulose ester with 0.8 μm pore size.

M.1.2 Number of Samples

M.1.2.1 TEM

A minimum of five samples inside and five outside the work site is recommended. When a negative air pressure ventilation system has been used during the abatement operation the "outside" samples should be collected outside the work site, but inside the building. This provides a comparison between the work site and the incoming air. If a negative air pressure ventilation system has not been used, the "outside" samples should be collected outdoors. These sample sizes are based on calculations of statistical reliability and on the following characteristics:

- The coefficient of variation for TEM measurements is between 100% and 150% based on data from EPA research studies.
- A false positive rate of .10 (i.e., based on the statistical test comparing inside and outside measurements, 10% of the "clean" work sites will fail and have to be recleaned).
- A false negative rate of at most .10 (i.e., the statistical test comparing inside and outside measurements will identify at least 90% of the sites that must be recleaned).

M.1.2.2 PCM

A minimum of five samples is recommended. A sample size of five controls the false negative error rate. At least 90% of the sites where the actual fiber concentration exceeds 0.01 f/cc will fail the test. If the actual concentration is 0.02 f/cc the probability of failure is 99%.

M.1.3 Location of Samplers

M.1.3.1 Indoors

Indoor samplers should be placed so they are not influenced by unusual air circulation patterns. Avoid corners of rooms and obstructions (like furniture). Within the above constraints, samplers should be placed at random around the work site. For example, if the site is a single room of 1000 or more sq. ft., the five samplers should be distributed in an approximately uniform manner. If the site includes more than five rooms, the rooms to be sampled may be selected randomly. The companion EPA document (USEPA 1985) describes this procedure in more detail.

When TEM is used for the air test and a negative air pressure ventilation system has been employed during the abatement operation, the five "outside" samplers should be placed outside the work site but inside the building, and the negative air system left running during sampling. These outside samplers should be located to avoid any air that might escape through the containment barriers. Minimum recommendations are at least 50 ft. from the entry portal to the work site, or 25 ft. from the plastic containment barriers.

M.1.3.2 Outdoors

If TEM is to be used for the air test and a negative air pressure ventilation system has not been used during abatement, then five samplers should be placed outdoors. These should be placed at ground level (about 2 meters high), if possible, and away from obstructions that may influence wind patterns. If access to electricity and concerns about security dictate a roof-top site, do not place samplers near vents or other structures on the roof.

M.1.4 Sampling Volumes

M.1.4.1 TEM

The required sampling volume for the TEM air test is calculated from the theoretical detection limit of the TEM analysis procedures, and from typical levels of asbestos against which measurements in the work site will be compared:

$$\text{Volume} = \frac{(1\ \text{f/10 grid squares})}{(0.005\ \text{f/cc})} \times \frac{(855\ \text{mm}^2)}{(0.0056\ \text{mm}^2)} \times \frac{(1\ \text{liter})}{(1000\ \text{cc})} = 3054\ \text{liters}$$

Where:

- 1 f/10 grid squares (the maximum recommended filter counting area) is the smallest number of fibers needed to make a non-zero measurement. (This is below the limit of reliable quantification.)
- 0.005 f/cc is a typical outdoor asbestos level in urban areas, as measured by TEM (Chatfield 1983).
- 855 mm^2 is the collection area of a 37 mm diameter filter.
- 0.0056 mm^2 is the area of each grid square (75 μm per side) in a 200 mesh electron microscope grid. This value will vary from 0.0056 to 0.0081 mm^2 for different grids. Larger grid squares will improve measurement accuracy for the same sampling volume.

This equation is appropriate for TEM analysis using a direct sample transfer technique (see Section M.2.1). If an indirect technique is used, the required sampling volume is increased in proportion to the dilution used. For example, if the sample is diluted by a factor of 10, the required volume is 10 times larger.

M.1.4.2 PCM

The equivalent PCM limit of reliable quantification for a sampling volume of 3000 liters is:

$$\text{Quantification Limit} = \frac{(10\ \text{f/100 fields})}{(3000\ \text{liters})} \times \frac{(855\ \text{mm}^2)}{(0.003\ \text{mm}^2)} \times \frac{(1\ \text{liter})}{(1000\ \text{cc})} = 0.01\ \text{f/cc}$$

Where:
- 10 f/100 fields is the limit of reliable quantification for the P&CAM 239 method.
- 855 mm^2 is the collection area of a 37 mm diameter filter.
- 0.003 mm^2 is the size of a typical field of view for a PCM microscope. This value will vary from 0.003 to 0.006 mm^2 for different microscopes. Larger fields of view will improve (decrease) the limit of reliable quantification.

By increasing the sampling volume, the PCM test criterion can be made proportionally more stringent:

Volume	Quantification Limit
3000 liters	0.01 f/cc
5000	0.006
7500	0.004

If the sampling scheme associated with the new NIOSH 7400 PCM method is used, the limit of reliable quantification will be lower for the same sampling volume.

M.1.5 Aggressive Sampling

Procedures for sampling aggressively are:

- Before starting the sampling pumps, direct the exhaust from forced air equipment (such as a 1 horsepower leaf blower) against all walls, ceilings, floors, ledges and other surfaces in the room. This should take at least 5 minutes per 1000 sq. ft. of floor.
- Place a 20-inch fan in the center of the room. (Use one fan per 10,000 cubic feet of room space.) Place the fan on slow speed and point it toward the ceiling.
- Start the sampling pumps and sample for the required time.
- Turn off the pump and then the fan(s) when sampling is complete.

M.2 Analysis

M.2.1 TEM

Use the update to the EPA provisional method (Yamate 1984). The sample should be transferred directly from the polycarbonate filter to the electron microscope grid. If high levels of organic materials are suspected or found, cellulose ester filters and indirect transfer (involving ashing, sonicating, and refiltering the fibers) is recommended. However, levels of airborne organic particles should be low in a cleaned work site.

M.2.2 PCM

Use the NIOSH P&CAM 239 method (NIOSH 1979). The newer NIOSH 7400 methods can also be used, although OSHA has yet to replace P&CAM 239 with 7400 for workplace compliance monitoring. NIOSH reports that 7400 is at least as accurate as P&CAM 239.

M.3 Interpretation of Results

M.3.1 TEM

Use student's "t" test to compare inside and outside levels.

- Compute the natural logarithm of fiber concentration for each sample.
- Compute means of the log transformed data for inside samples and outside samples.
- Form the ratio

$$T = \frac{\bar{y}_1 - \bar{y}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where:

$\bar{y}_1$ = average of log concentrations inside the work site

$\bar{y}_2$ = average of log concentrations outside the work site

$S = [(\Sigma (y_{1j} - \bar{y}_1)^2 + \Sigma (y_{2j} - \bar{y}_2)^2)/(n_1 + n_2 - 2)]^{1/2}$

n_1 = number of samples collected inside the work site

n_2 = number of samples collected outside the work site

Then compare T to the 95 percentile point of a "t" distribution with $n_1 + n_2 - 2$ degrees of freedom. (When 5 samples are collected inside and outside the 95 percentile point is 1.86.) If T exceeds the 95 percentile point, reclean. Otherwise, release the contractor.

The following two examples illustrate the method:

Example 1

Measurements inside the work site (f/cc)	Measurements outside the work site (f/cc)
0.002	0.001
0.007	0.010
0.030	0.008
0.028	0.001
0.001	0.025
$\bar{y}_1 = -5.03$	$\bar{y}_2 = -5.39$

$S = 1.49$

$T = 0.38$

T is less than 1.86. The contractor is released.

Example 2

Measurements inside the work site (f/cc)	Measurements outside the work site (f/cc)
0.052	0.001
0.130	0.010
0.005	0.008
0.240	0.001
0.375	0.025
$\bar{y}_1 = -2.54$	$\bar{y}_2 = -5.39$

$S = 1.59$

$T = 2.84$

T is greater than 1.86. The site must be recleaned.

The test is based on the assumption that a homogenous work site has been selected. If one sample has a much higher concentration than the others it is possible that the site is not homogenous. Common sense should prevail in this case. Irrespective of the result of the "t" test, the high value should be investigated. The sample should be reanalyzed, additional samples collected, or the site recleaned and tested before the contractor is released.

M.3.2 PCM

The measured level of each sample is compared with the PCM limit of reliable quantification for the volume of air sampled (approximately 0.01 f/cc for 3000 liters). If any of the samples exceeds 0.01 f/cc, the work site must be re-cleaned.

program determined to be inadequate, and specifies the facts that underlie the findings of inadequacy.

§ 763.99 Exclusions.

(a) A local education agency shall not be required to perform an inspection under § 763.85(a) in any sampling area as defined in 40 CFR 763.103 or homogeneous area of a school building where:

(1) An accredited inspector has determined that, based on sampling records, friable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall assess the friable ACBM under § 763.88.

(2) An accredited inspector has determined that, based on sampling records, nonfriable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable has become friable since that previous inspection and shall assess the newly-friable ACBM under § 763.88.

(3) Based on sampling records and inspection records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled, before December 14, 1987 in substantial compliance with § 763.85(a), which for purposes of this section means in a random manner and with a sufficient number of samples to reasonably ensure that the area is not ACBM.

(i) The accredited inspector shall sign and date a statement, with his or her State of accreditation and if applicable, accreditation number that the homogeneous or sampling area determined not to be ACBM was sampled in substantial compliance with § 763.85(a).

(ii) Within 30 days after the inspector's determination, the local education agency shall submit a copy of the inspector's statement to the EPA Regional Office and shall include the statement in the management plan for that school.

(4) The lead agency responsible for asbestos inspection in a State that has been granted a waiver from § 763.85(a) has determined that, based on sampling records and inspection records, no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled before December 14, 1987, in substantial compliance with § 763.85(a). Such determination shall be included in the management plan for that school.

(5) An accredited inspector has determined that, based on records of an inspection conducted before December 14, 1987, suspected ACBM identified in that homogeneous or sampling area is assumed to be ACM. The inspector shall sign and date a statement to that effect, with his or her State of accreditation and if applicable, accreditation number and, within 30 days of such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable suspected ACBM assumed to be ACM has become friable since the previous inspection and shall assess the newly friable material and previously identified friable suspected ACBM assumed to be ACM under § 763.88.

(6) Based on inspection records and contractor and clearance records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area where asbestos removal operations have been conducted before December 14, 1987, and shall sign and date a statement to that effect and include his or her State of accreditation and, if applicable, accreditation number. The local education agency shall submit a copy of the statement to the EPA Regional Office and shall include the statement in the management plan for that school.

(7) An architect or project engineer responsible for the construction of a new school building built after October 12, 1988, or an accredited inspector signs a statement that no ACBM was specified as a building material in any construction document for the building, or, to the best of his or her knowledge, no ACBM was used as a building material in the building. The local education agency shall submit a copy of the signed statement of the architect, project engineer, or accredited inspector to the EPA Regional Office and shall include the statement in the management plan for that school.

(b) The exclusion, under paragraph (a)(1) through (4) of this section, from conducting the inspection under § 763.85(a) shall apply only to homogeneous or sampling areas of a school building that were inspected and sampled before October 17, 1987. The local education agency shall conduct an inspection under § 763.85(a) of all areas inspected before October 17, 1987, that were not sampled or were not assumed to be ACM.

(c) If ACBM is subsequently found in a homogeneous or sampling area of a local education agency that had been identified as receiving an exclusion by an accredited inspector under paragraphs (a) (3), (4), (5) of this section, or an architect, project engineer or accredited inspector under paragraph (a)(7) of this section, the local education agency shall have 180 days following the date of identification of ACBM to comply with this Subpart E.

Appendix A to Subpart E—Interim Transmission Electron Microscopy Analytical Methods—Mandatory and Nonmandatory—and Mandatory Section to Determine Completion of Response Actions

I. Introduction

The following appendix contains three units. The first unit is the mandatory transmission electron microscopy (TEM) method which all laboratories must follow; it is the minimum requirement for analysis of air samples for asbestos by TEM. The mandatory method contains the essential elements of the TEM method. The second unit contains the complete non-mandatory method. The non-mandatory method supplements the mandatory method by including additional steps to improve the analysis. EPA recommends that the non-mandatory method be employed for analyzing air filters; however, the laboratory may choose to employ the mandatory method. The non-mandatory method contains the same minimum requirements as are outlined in the mandatory method. Hence, laboratories may choose either of the two methods for analyzing air samples by TEM.

The final unit of this Appendix A to Subpart E defines the steps which must be taken to determine completion of response actions. This unit is mandatory.

II. Mandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. "Analytical sensitivity"—Airborne asbestos concentration represented by each fiber counted under the electron

microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 structures/cm².

2. "Asbestiform"—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. "Aspect ratio"—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. "Bundle"—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. "Clean area"—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a maximum of 53 structures/mm² for any single preparation for that same area.

6. "Cluster"—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. "ED"—Electron diffraction.

8. "EDXA"—Energy dispersive X-ray analysis.

9. "Fiber"—A structure greater than or equal to 0.5 μm in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. "Grid"—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. "Intersection"—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. "Laboratory sample coordinator"—That person responsible for the conduct of sample handling and the certification of the testing procedures.

13. "Filter background level"—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on a blank (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm².

14. "Matrix"—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. "NSD"—No structure detected.

16. "Operator"—A person responsible for the TEM instrumental analysis of the sample.

17. "PCM"—Phase contrast microscopy.

18. "SAED"—Selected area electron diffraction.

19. "SEM"—Scanning electron microscope.

20. "STEM"—Scanning transmission electron microscope.

21. "Structure"—a microscopic bundle, cluster, fiber, or matrix that may contain asbestos.

22. "S/cm³"—Structures per cubic centimeter.

23. "S/mm²"—Structures per square millimeter.

24. "TEM"—Transmission electron microscope.

B. Sampling

1. The sampling agency must have written quality control procedures and documents which verify compliance.

2. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (References 1, 2, 3 and 5 of Unit II.J.).

3. Sampling for airborne asbestos following an abatement action must use commercially available cassettes.

4. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm² for that same area is acceptable for this method.

5. Use sample collection filters that are either polycarbonate having a pore size less than or equal to 0.4 μm or mixed cellulose ester having a pore size less than or equal to 0.45 μm.

6. Place these filters in series with a 5.0 μm backup filter (to serve as a diffuser) and a support pad. See the following Figure 1:

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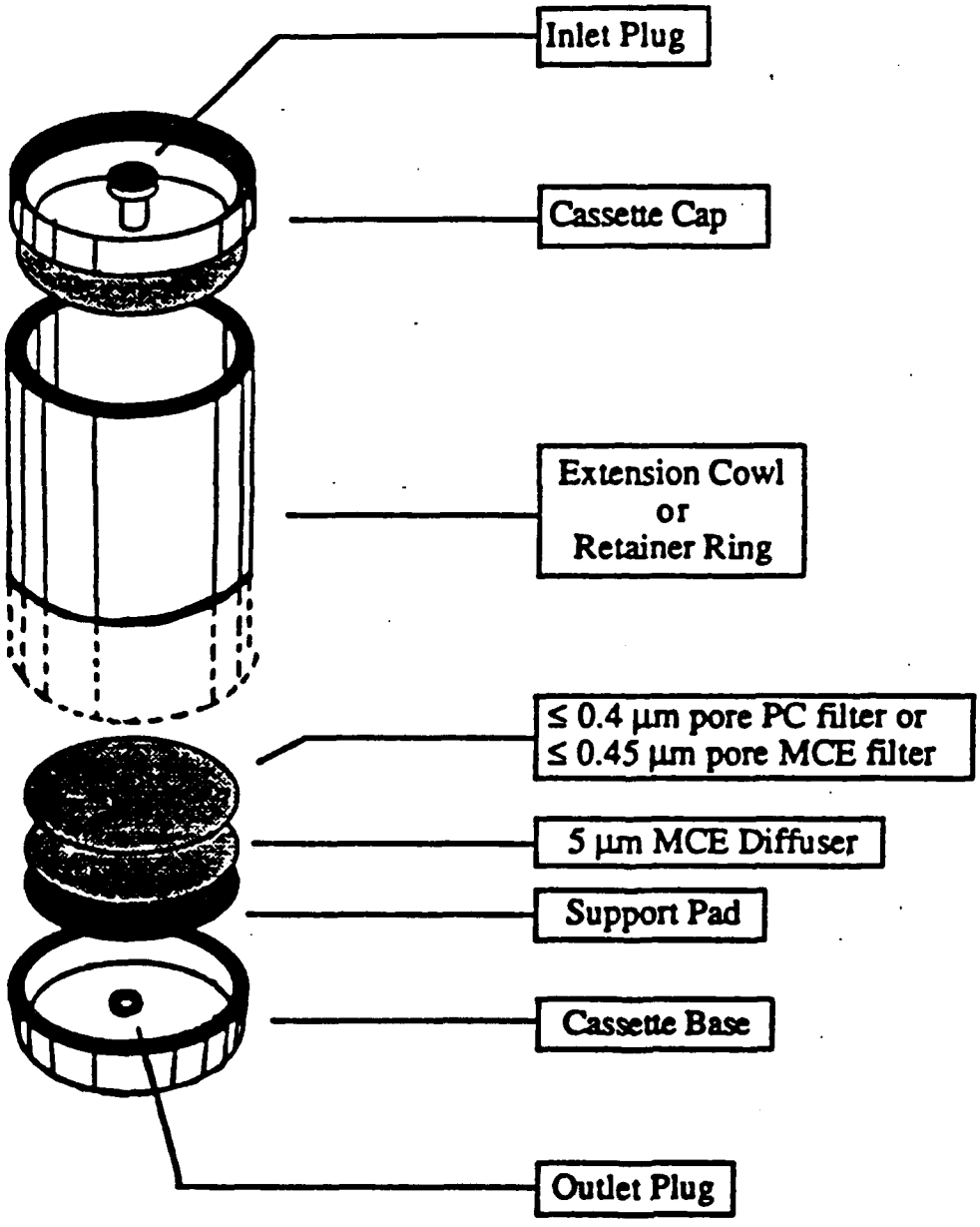
FIGURE I--SAMPLING CASSETTE CONFIGURATION



BILLING CODE 6560-50-C

7. Reloading of used cassettes is not permitted.

8. Orient the cassette downward at approximately 45 degrees from the horizontal.

9. Maintain a log of all pertinent sampling information.

10. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter (not the filter which will be used in sampling) before and after the sampling operation.

11. Record all calibration information.

12. Ensure that the mechanical vibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

13. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by damping out any pump action fluctuations if necessary.

14. The final plastic barrier around the abatement area remains in place for the sampling period.

15. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust. (See suggested protocol in Unit III.B.7.d.)

16. Select an appropriate flow rate equal to or greater than 1 liter per minute (L/min) or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

17. A minimum of 13 samples are to be collected for each testing site consisting of the following:

a. A minimum of five samples per abatement area.

b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c. Two field blanks are to be taken by removing the cap for not more than 30 seconds and replacing it at the time of sampling before sampling is initiated at the following places:

i. Near the entrance to each abatement area.

ii. At one of the ambient sites. (DO NOT leave the field blanks open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

18. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

19. The following Table I specifies volume ranges to be used:

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TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS (0.0057 MM^2) THAT NEED TO BE ANALYZED TO MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC BASED ON VOLUME AND EFFECTIVE FILTER AREA

Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
560	*24*	*1,250*	*24*
600	23	1,300	23
700	19	1,400	21
800	17	1,600	19
900	15	1,800	17
1,000	14	2,000	15
1,100	12	2,200	14
1,200	11	2,400	13
1,300	10	2,600	12
1,400	10	2,800	11
1,500	9	3,000	10
1,600	8	3,200	9
1,700	8	3,400	9
1,800	8	3,600	8
1,900	7	3,800	8
2,000	7	4,000	8
2,100	6	4,200	7
2,200	6	4,400	7
2,300	6	4,600	7
2,400	6	4,800	6
2,500	5	5,000	6
2,600	5	5,200	6
2,700	5	5,400	6
2,800	5	5,600	5
2,900	5	5,800	5
3,000	5	6,000	5
3,100	4	6,200	5
3,200	4	6,400	5
3,300	4	6,600	5
3,400	4	6,800	4
3,500	4	7,000	4
3,600	4	7,200	4
3,700	4	7,400	4
3,800	4	7,600	4

Recommended Volume Range

Recommended Volume Range

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

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20. Ensure that the sampler is turned upright before interrupting the pump flow.

21. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

22. Ensure that the samples are stored in a secure and representative location.

23. Do not change containers if portions of these filters are taken for other purposes.

24. A summary of Sample Data Quality Objectives is shown in the following Table II:

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TABLE II--SUMMARY OF SAMPLING AGENCY DATA QUALITY OBJECTIVES

This table summarizes the data quality objectives from the performance of this method in terms of precision, accuracy, completeness, representativeness, and comparability. These objectives are assured by the periodic control checks and reference checks listed here and described in the text of the method.

Unit Operation	QC Check	Frequency	Conformance Expectation
Sampling materials	Sealed blank	1 per I/O site	95%
Sample procedures	Field blanks	2 per I/O site	95%
	Pump calibration	Before and after each field series	90%
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample shipment	Review of sending report	Each sample	95% complete

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C. Sample Shipment

Ship bulk samples to the analytical laboratory in a separate container from air samples.

D. Sample Receiving

1. Designate one individual as sample coordinator at the laboratory. While that individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

E. Sample Preparation

1. All sample preparation and analysis shall be performed by a laboratory independent of the abatement contractor.

2. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them into the clean room facility.

3. Perform sample preparation in a well-equipped clean facility.

Note: The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA-filtered. The cumulative analytical blank concentration must average less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm² for that same area.

4. Preparation areas for air samples must not only be separated from preparation areas for bulk samples, but they must be prepared in separate rooms.

5. Direct preparation techniques are required. The object is to produce an intact film containing the particulates of the filter surface which is sufficiently clear for TEM analysis.

a. TEM Grid Opening Area measurement must be done as follows:

i. The filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique.

ii. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass and examining it under the PCM. Use a calibrated graticule to measure the average field diameters. From the data, calculate the field area for an average grid opening.

iii. Measurements can also be made on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

b. TEM specimen preparation from polycarbonate (PC) filters. Procedures as described in Unit III.G. or other equivalent methods may be used.

c. TEM specimen preparation from mixed cellulose ester (MCE) filters.

i. Filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique or the Burdette procedure (Ref. 7 of Unit II.J.)

ii. Plasma etching of the collapsed filter is required. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the conditions that should be used. Insufficient etching will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for the particulate asher and operating conditions will then be set such that a 1–2 μm (10 percent) layer of collapsed surface will be removed.

iii. Procedures as described in Unit III. or other equivalent methods may be used to prepare samples.

F. TEM Method

1. An 80–120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations is required. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm in diameter at crossover. The microscope shall be calibrated routinely for magnification and camera constant.

2. Determination of Camera Constant and ED Pattern Analysis. The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulate. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter of the rings times the interplanar spacing of the ring being measured.

3. Magnification Calibration. The magnification calibration must be done at the fluorescent screen. The TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica (e.g., one containing 2,160 lines/mm). Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric). A logbook must be maintained, and the dates of calibration and the values obtained must be recorded. The frequency of calibration depends on the past history of the particular microscope. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate an eucentric tilting specimen stage, all specimens and the cross grating replica must be placed at the eucentric position.

4. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory.

5. Microscope settings: 80–120 kV, grid assessment 250–1,000X, then 15,000–20,000X screen magnification for analysis.

6. Approximately one-half (0.5) of the predetermined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample preparation.

7. Individual grid openings with greater than 5 percent openings (holes)

or covered with greater than 25 percent particulate matter or obviously having nonuniform loading must not be analyzed.

8. Reject the grid if:

a. *Less than 50 percent* of the grid openings covered by the replica are intact.

b. The replica is doubled or folded.

c. The replica is too dark because of incomplete dissolution of the filter.

9. Recording Rules.

a. Any continuous grouping of particles in which an asbestos fiber with an aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm is detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are to be described as cluster or matrix. An intersection is a nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. See the following Figure 2:

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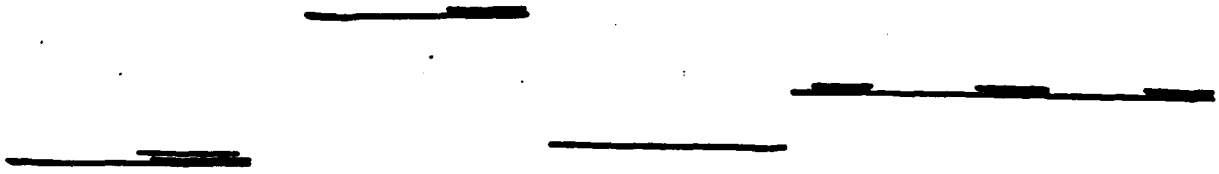
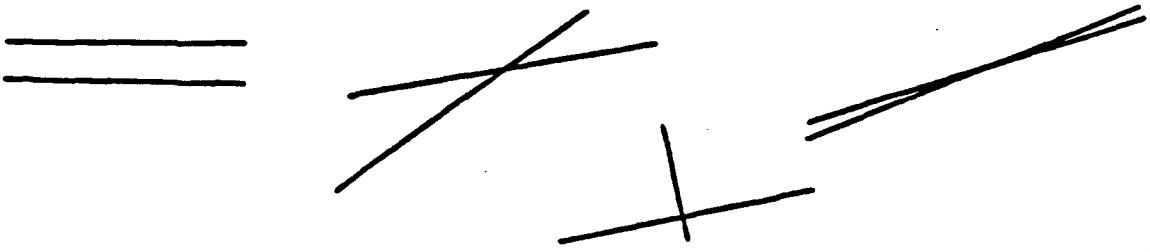
FIGURE 2--COUNTING GUIDELINES USED IN DETERMINING ASBESTOS STRUCTURES

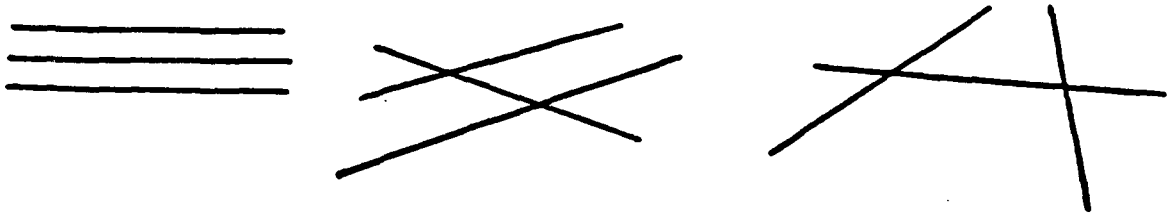
Count as 1 fiber; 1 Structure; no intersections.



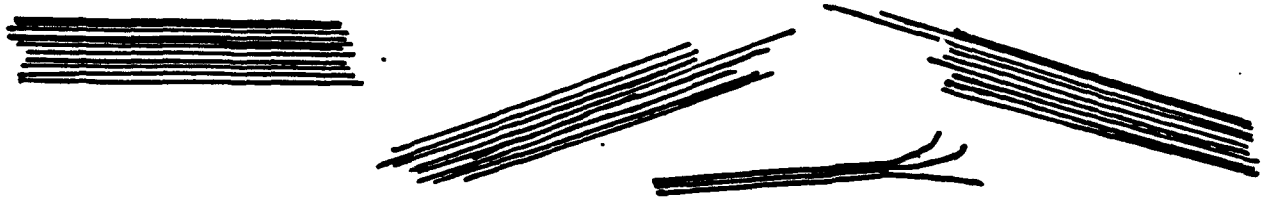
Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.



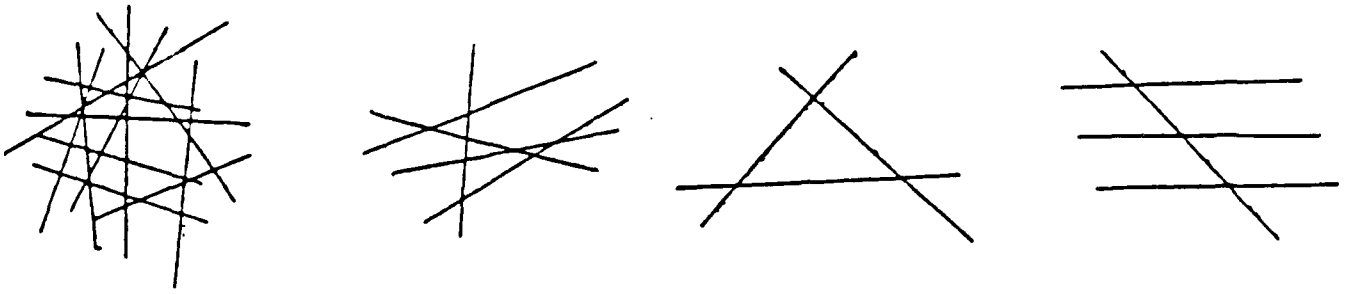
Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.



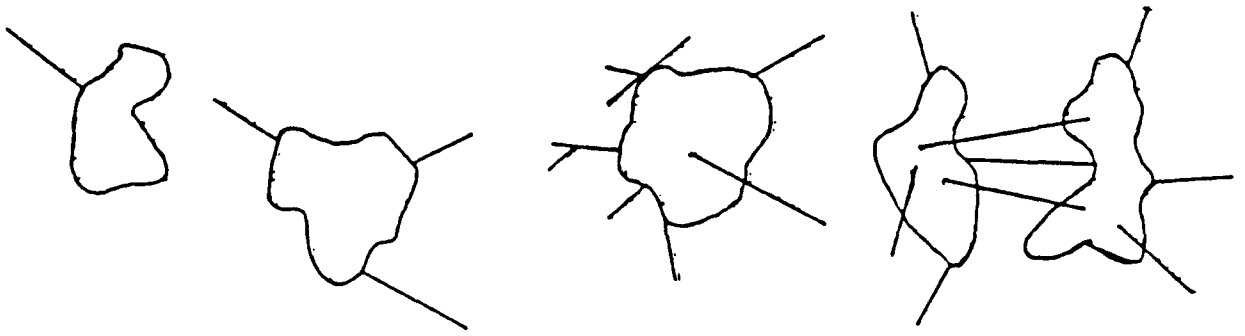
Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.



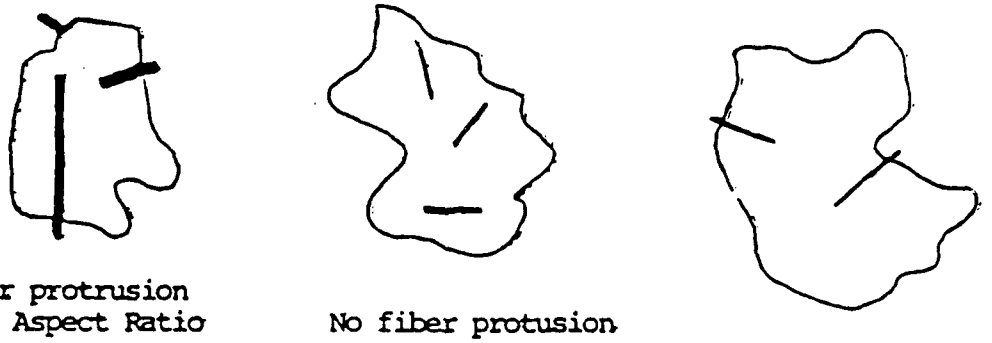
Count clusters as 1 structure; fibers having greater than or equal to 3 intersections.



Count matrix as 1 structure.



DO NOT COUNT AS STRUCTURES:



Fiber protrusion
<5:1 Aspect Ratio

No fiber protusion

Fiber protrusion
<0.5 micrometer

—— <0.5 micrometer in length
▬ <5:1 Aspect Ratio

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i. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

iv. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

b. Separate categories will be maintained for fibers less than 5 μm and for fibers equal to or greater than 5 μm in length.

c. Record NSD no structures are detected in the field.

d. Visual identification of electron diffraction (ED) patterns is required for each asbestos structure counted which would cause the analysis to exceed the 70 s/mm² concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

e. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. In the event that examination of the pattern by a qualified individual indicates that the pattern has been misidentified visually, the client shall be contacted.

f. Energy Dispersive X-ray Analysis (EDXA) is required of all amphiboles which would cause the analysis results to exceed the 70 s/mm² concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

g. If the number of fibers in the nonasbestos class would cause the analysis to exceed the 70 s/mm² concentration, the fact that they are not asbestos must be confirmed by EDXA or measurement of a zone axis diffraction pattern.

h. Fibers classified as chrysotile must be identified by diffraction or X-ray analysis and recorded on a count sheet. X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.

i. Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.)

j. If a diffraction pattern was recorded on film, record the micrograph number on the count sheet.

k. If an electron diffraction was attempted but no pattern was observed, record N on the count sheet.

l. If an EDXA spectrum was attempted but not observed, record N on the count sheet.

m. If an X-ray analysis spectrum is stored, record the file and disk number on the count sheet.

10. Classification Rules.

a. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

b. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

c. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

d. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

11. After finishing with a grid, remove it from the microscope, and replace it in the appropriate grid holder. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

G. Sample Analytical Sequence

1. Under the present sampling requirements a minimum of 13 samples is to be collected for the clearance testing of an abatement site. These include five abatement area samples, five ambient samples, two field blanks, and one sealed blank.

2. Carry out visual inspection of work site prior to air monitoring.

3. Collect a minimum of 5 air samples inside the work site and 5 samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

4. Remaining steps in the analytical sequence are contained in Unit IV of this Appendix.

H. Reporting

1. The following information must be reported to the client for each sample analyzed:

a. Concentration in structures per square millimeter and structures per cubic centimeter.

b. Analytical sensitivity used for the analysis.

c. Number of asbestos structures.

d. Area analyzed.

e. Volume of air sampled (which must be initially supplied to lab by client).

f. Copy of the count sheet must be included with the report.

g. Signature of laboratory official to indicate that the laboratory met specifications of the method.

h. Report form must contain official laboratory identification (e.g., letterhead).

i. Type of asbestos.

I. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards are to be performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

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TABLE III--SUMMARY OF LABORATORY DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

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1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks. Testing with blanks must also be done after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If there are more than 53 fibers/mm ^{2} per 10 200-mesh grid openings, the system must be checked for possible sources of contamination.

6. Perform a system check on the transmission electron microscope daily.

7. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III under Unit II.I.

8. Ensure qualified operator performance by evaluation of replicate analysis and standard sample comparisons as set forth in Table III under Unit II.I.

9. Validate all data entries.

10. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III under Unit II.I.

11. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns.

12. Appropriate logs or records must be maintained by the analytical laboratory verifying that it is in compliance with the mandatory quality assurance procedures.

J. References

For additional background information on this method, the following references should be consulted.

1. "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024, June 1985.

2. "Measuring Airborne Asbestos Following an Abatement Action," USEPA, Office of Toxic Substances, EPA 600/4-85-049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4-77-027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J., Health & Safety Exec. Research & Lab. Services Div., London, "Proposed Analytical Method for Determination of Asbestos in Air."

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc., "Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Electron Microscopy Using Polycarbonate Membrane Filters," WERL SOP 87-1, March 5, 1987.

9. NIOSH Method 7402 for Asbestos Fibers, 12-11-86 Draft.

10. Yamate, G., Agarwall, S.C., Gibbons, R.D., IIT Research Institute, "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," Draft report, USEPA Contract 68-02-3266, July 1984.

11. "Guidance to the Preparation of Quality Assurance Project Plans," USEPA, Office of Toxic Substances, 1984.

III. Nonmandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. "Analytical sensitivity"—Airborne asbestos concentration represented by each fiber counted under the electron microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 s/cm^3.

2. "Asbestiform"—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. "Aspect ratio"—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. "Bundle"—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. "Clean area"—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm^2 in an area of 0.057 mm^2 (nominally 10 200 mesh grid openings) and a maximum of 53 structures/mm^2 for no more than one single preparation for that same area.

6. "Cluster"—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. "ED"—Electron diffraction.

8. "EDXA"—Energy dispersive X-ray analysis.

9. "Fiber"—A structure greater than or equal to 0.5 μm in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. "Grid"—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. "Intersection"—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. "Laboratory sample coordinator"—That person responsible for the conduct of sample handling and the certification of the testing procedures.

13. "Filter background level"—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on blanks (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm^2.

14. "Matrix"—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. "NSD"—No structure detected.

16. "Operator"—A person responsible for the TEM instrumental analysis of the sample.

17. "PCM"—Phase contrast microscopy.

18. "SAED"—Selected area electron diffraction.

19. "SEM"—Scanning electron microscope.

20. "STEM"—Scanning transmission electron microscope.

21. "Structure"—a microscopic bundle, cluster, fiber, or matrix which may contain asbestos.

22. "S/cm²"—Structures per cubic centimeter.

23. "S/mm²"—Structures per square millimeter.

24. "TEM"—Transmission electron microscope.

B. Sampling

1. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (See References 1, 2, and 5 of Unit III.L.) Special precautions should be taken to avoid contamination of the sample. For example, materials that have not been prescreened for their asbestos background content should not be used; also, sample handling procedures which do not take cross contamination possibilities into account should not be used.

2. Material and supply checks for asbestos contamination should be made on all critical supplies, reagents, and procedures before their use in a monitoring study.

3. Quality control and quality assurance steps are needed to identify problem areas and isolate the cause of the contamination (see Reference 5 of Unit III.L.). Control checks shall be permanently recorded to document the quality of the information produced. The sampling firm must have written quality control procedures and documents which verify compliance. Independent audits by a qualified consultant or firm should be performed once a year. All documentation of compliance should be retained indefinitely to provide a guarantee of quality. A summary of Sample Data Quality Objectives is shown in Table II of Unit II.B.

4. Sampling materials.

a. Sample for airborne asbestos following an abatement action using commercially available cassettes.

b. Use either a cowling or a filter-retaining middle piece. Conductive material may reduce the potential for particulates to adhere to the walls of the cowl.

c. Cassettes must be verified as "clean" prior to use in the field. If packaged filters are used for loading or preloaded cassettes are purchased from the manufacturer or a distributor, the manufacturer's name and lot number should be entered on all field data sheets provided to the laboratory, and are required to be listed on all reports from the laboratory.

d. Assemble the cassettes in a clean facility (See definition of clean area under Unit III.A.).

e. Reloading of used cassettes is not permitted.

f. Use sample collection filters which are either polycarbonate having a pore size of less than or equal to 0.4 μm or mixed cellulose ester having a pore size of less than or equal to 0.45 μm.

g. Place these filters in series with a backup filter with a pore size of 5.0 μm (to serve as a diffuser) and a support pad. See the following Figure 1:

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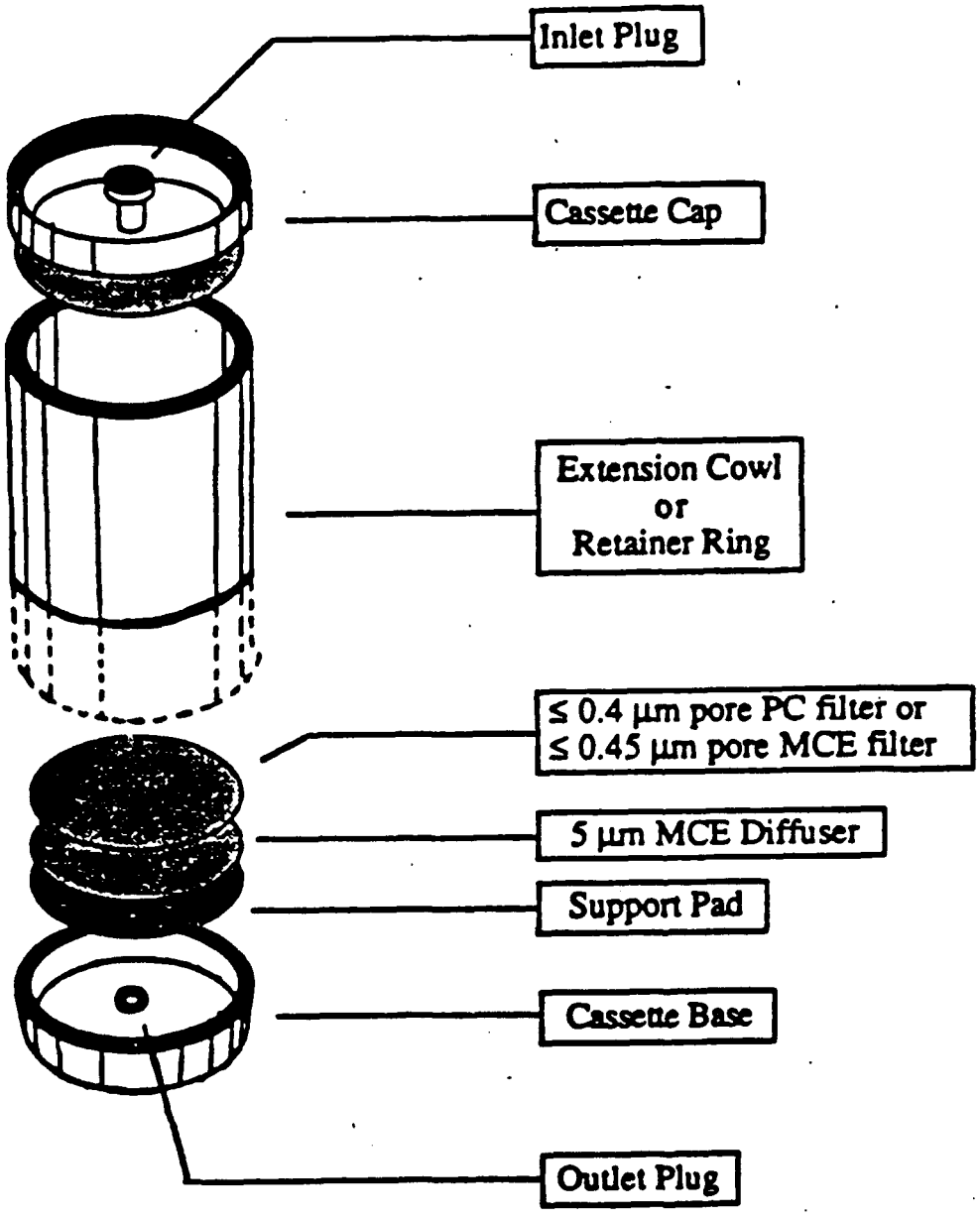
FIGURE I--SAMPLING CASSETTE CONFIGURATION



BILLING CODE 6560-50-C

h. When polycarbonate filters are used, position the highly reflective face such that the incoming particulate is received on this surface.

i. Seal the cassettes to prevent leakage around the filter edges or between cassette part joints. A mechanical press may be useful to achieve a reproducible leak-free seal. Shrink fit gel-bands may be used for this purpose and are available from filter manufacturers and their authorized distributors.

j. Use wrinkle-free loaded cassettes in the sampling operation.

5. Pump setup.

a. Calibrate the sampling pump over the range of flow rates and loads anticipated for the monitoring period with this flow measuring device in series. Perform this calibration using guidance from EPA Method 2A each time the unit is sent to the field (See Reference 6 of Unit III.L.).

b. Configure the sampling system to preclude pump vibrations from being transmitted to the cassette by using a sampling stand separate from the pump station and making connections with flexible tubing.

c. Maintain continuous smooth flow conditions by damping out any pump action fluctuations if necessary.

d. Check the sampling system for leaks with the end cap still in place and the pump operating before initiating sample collection. Trace and stop the source of any flow indicated by the flowmeter under these conditions.

e. Select an appropriate flow rate equal to or greater than 1 L/min or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

f. Orient the cassette downward at approximately 45 degrees from the horizontal.

g. Maintain a log of all pertinent sampling information, such as pump identification number, calibration data, sample location, date, sample identification number, flow rates at the beginning, middle, and end, start and stop times, and other useful information or comments. Use of a sampling log form is recommended. See the following Figure 2:

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FIGURE 2--SAMPLING LOG FORM

Sample Number	Location of Sample	Pump I.D.	Start Time	Middle Time	End Time	Flow Rate

Inspector: _____ Date: _____

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h. Initiate a chain of custody procedure at the start of each sampling, if this is requested by the client.

i. Maintain a close check of all aspects of the sampling operation on a regular basis.

j. Continue sampling until at least the minimum volume is collected, as specified in the following Table I:

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TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS (0.0057 MM^2) THAT NEED TO BE ANALYZED TO MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC BASED ON VOLUME AND EFFECTIVE FILTER AREA

	Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
	Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
	560	*24*	*1,250*	*24*
	600	23	1,300	23
	700	19	1,400	21
	800	17	1,600	19
	900	15	1,800	17
	1,000	14	2,000	15
	1,100	12	2,200	14
	1,200	11	2,400	13
	1,300	10	2,600	12
Recommended Volume Range	1,400	10	2,800	11
	1,500	9	3,000	10
	1,600	8	3,200	9
	1,700	8	3,400	9
	1,800	8	3,600	8
	1,900	7	3,800	8
	2,000	7	4,000	8
	2,100	6	4,200	7
	2,200	6	4,400	7
	2,300	6	4,600	7
	2,400	6	4,800	6
	2,500	5	5,000	6
	2,600	5	5,200	6
	2,700	5	5,400	6
	2,800	5	5,600	5
	2,900	5	5,800	5
	3,000	5	6,000	5
	3,100	4	6,200	5
	3,200	4	6,400	5
	3,300	4	6,600	5
	3,400	4	6,800	4
	3,500	4	7,000	4
	3,600	4	7,200	4
	3,700	4	7,400	4
	3,800	4	7,600	4
				Recommended Volume Range

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

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k. At the conclusion of sampling, turn the cassette upward before stopping the flow to minimize possible particle loss. If the sampling is resumed, restart the flow before reorienting the cassette downward. Note the condition of the filter at the conclusion of sampling.

l. Double check to see that all information has been recorded on the data collection forms and that the cassette is securely closed and appropriately identified using a waterproof label. Protect cassettes in individual clean resealed polyethylene bags. Bags are to be used for storing cassette caps when they are removed for sampling purposes. Caps and plugs should only be removed or replaced using clean hands or clean disposable plastic gloves.

m. Do not change containers if portions of these filters are taken for other purposes.

6. Minimum sample number per site. A minimum of 13 samples are to be collected for each testing consisting of the following:

a. A minimum of five samples per abatement area.

b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c. Two field blanks are to be taken by removing the cap for not more than 30 sec and replacing it at the time of sampling before sampling is initiated at the following places:

i. Near the entrance to each ambient area.

ii. At one of the ambient sites.

(Note: Do not leave the blank open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

7. Abatement area sampling.

a. Conduct final clearance sampling only after the primary containment barriers have been removed; the abatement area has been thoroughly dried; and, it has passed visual inspection tests by qualified personnel. (See Reference 1 of Unit III.L.)

b. Containment barriers over windows, doors, and air passageways must remain in place until the TEM clearance sampling and analysis is completed and results meet clearance test criteria. The final plastic barrier remains in place for the sampling period.

c. Select sampling sites in the abatement area on a random basis to provide unbiased and representative samples.

d. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust.

i. Equipment used in aggressive sampling such as a leaf blower and/or fan should be properly cleaned and decontaminated before use.

ii. Air filtration units shall remain on during the air monitoring period.

iii. Prior to air monitoring, floors, ceiling and walls shall be swept with the exhaust of a minimum one (1) horsepower leaf blower.

iv. Stationary fans are placed in locations which will not interfere with air monitoring equipment. Fan air is directed toward the ceiling. One fan shall be used for each 10,000 ft ^{3} of worksite.

v. Monitoring of an abatement work area with high-volume pumps and the use of circulating fans will require electrical power. Electrical outlets in the abatement area may be used if available. If no such outlets are available, the equipment must be supplied with electricity by the use of extension cords and strip plug units. All electrical power supply equipment of this type must be approved Underwriter Laboratory equipment that has not been modified. All wiring must be grounded. Ground fault interrupters should be used. Extreme care must be taken to clean up any residual water and ensure that electrical equipment does not become wet while operational.

vi. Low volume pumps may be carefully wrapped in 6-mil polyethylene to insulate the pump from the air. High volume pumps cannot be sealed in this manner since the heat of the motor may melt the plastic. The pump exhausts should be kept free.

vii. If recleaning is necessary, removal of this equipment from the work area must be handled with care. It is not possible to completely decontaminate the pump motor and parts since these areas cannot be wetted. To minimize any problems in this area, all equipment such as fans and pumps should be carefully wet wiped prior to removal from the abatement area. Wrapping and sealing low volume pumps in 6-mil polyethylene will provide easier decontamination of this equipment. Use of clean water and disposable wipes should be available for this purpose.

e. Pump flow rate equal to or greater than 1 L/min or less than 10 L/min may be used for 25 mm cassettes. The larger cassette diameters may have comparably increased flow.

f. Sample a volume of air sufficient to ensure the minimum quantitation limits. (See Table I of Unit III.B.5.j.)

8. Ambient sampling.

a. Position ambient samplers at locations representative of the air entering the abatement site. If makeup air entering the abatement site is drawn from another area of the building which is outside of the abatement area, place the pumps in the building, pumps should be placed out of doors located near the building and away from any obstructions that may influence wind patterns. If construction is in progress immediately outside the enclosure, it may be necessary to select another ambient site. Samples should be representative of any air entering the work site.

b. Locate the ambient samplers at least 3 ft apart and protect them from adverse weather conditions.

c. Sample same volume of air as samples taken inside the abatement site.

C. Sample Shipment

1. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

2. Select a rigid shipping container and pack the cassettes upright in a noncontaminating nonfibrous medium such as a bubble pack. The use of resealable polyethylene bags may help to prevent jostling of individual cassettes.

3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

4. Include a shipping bill and a detailed listing of samples shipped, their descriptions and all identifying numbers or marks, sampling data, shipper's name, and contact information. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.

5. Hand-carry samples to the laboratory in an upright position if possible; otherwise choose that mode of transportation least likely to jar the samples in transit.

6. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain of custody and sample tracking procedures. This will also help the laboratory schedule timely analysis for the samples when they are received.

D. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of

sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined, and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the text below.

1. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a maximum of 53 s/mm² for that same area for any single preparation is acceptable for this method.

2. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter—not the filter which will be used in sampling—before and after the sampling operation.

3. Record all calibration information with the data to be used on a standard sampling form.

4. Ensure that the samples are stored in a secure and representative location.

5. Ensure that mechanical calibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

6. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by installing a damping chamber if necessary.

7. Open a loaded cassette momentarily at one of the indoor sampling sites when sampling is initiated. This sample will serve as an indoor field blank.

8. Open a loaded cassette momentarily at one of the outdoor sampling sites when sampling is initiated. This sample will serve as an outdoor field blank.

9. Carry a sealed blank into the field with each sample series. Do not open this cassette in the field.

10. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

11. Ensure that the sampler is turned upright before interrupting the pump flow.

12. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

E. Sample Receiving

1. Designate one individual as sam coordinator at the laboratory. While individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Adhere to the following procedures to ensure both the continued chain-of-custody and the accountability of all samples passing through the laboratory:

a. Note the condition of the shipping package and data written on it upon receipt.

b. Retain all bills of lading or shipping slips to document the shipper and delivery time.

c. Examine the chain-of-custody seal, if any, and the package for its integrity.

d. If there has been a break in the seal or substantive damage to the package, the sample coordinator shall immediately notify the shipper and a responsible laboratory manager before any action is taken to unpack the shipment.

e. Packages with significant damage shall be accepted only by the responsible laboratory manager after discussions with the client.

3. Unwrap the shipment in a clean, uncluttered facility. The sample coordinator or his or her designee will record the contents, including a description of each item and all identifying numbers or marks. A Sample Receiving Form to document this information is attached for use when necessary. (See the following Figure 3.)

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FIGURE 3--SAMPLE RECEIVING FORM

Date of package delivery _____ Package shipped from _____

Carrier _____ Shipping bill retained _____

*Condition of package on receipt _____

*Condition of custody seal _____

Number of samples received _____ Shipping manifest attached _____

Purchase Order No. _____ Project I.D. _____

Comments _____

No.	Description	Sampling Medium PC	Sampling Medium MCE	Sampled Volume Liters	Receiving ID #	Assigned #
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

(Use as many additional sheets as needed.)

Comments _____

Date of acceptance into sample bank _____

Signature of chain-of-custody recipient _____

Disposition of samples _____

*Note: If the package has sustained substantial damage or the custody seal is broken, stop and contact the project manager and the shipper.

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Note.—The person breaking the chain-of-custody seal and itemizing the contents assumes responsibility for the shipment and signs documents accordingly.

4. Assign a laboratory number and schedule an analysis sequence.

5. Manage all chain-of-custody samples within the laboratory such that their integrity can be ensured and documented.

F. Sample Preparation

1. Personnel not affiliated with the Abatement Contractor shall be used to prepare samples and conduct TEM analysis. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them to the clean sample preparation facility.

2. Perform sample preparation in a well-equipped clean facility.

Note.—The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA filtered. The cumulative analytical blank concentration must average less than 18 s/mm² in an area of 0.057 s/mm² (nominally 10 200-mesh grid openings) with no more than one single preparation to exceed 53 s/mm² for that same area.

3. Preparation areas for air samples must be separated from preparation areas for bulk samples. Personnel must not prepare air samples if they have previously been preparing bulk samples without performing appropriate personal hygiene procedures, i.e., clothing change, showering, etc.

4. Preparation. Direct preparation techniques are required. The objective is to produce an intact carbon film containing the particulates from the filter surface which is sufficiently clear for TEM analysis. Currently recommended direct preparation procedures for polycarbonate (PC) and mixed cellulose ester (MCE) filters are described in Unit III.F.7. and 8. Sample preparation is a subject requiring additional research. Variation on those steps which do not substantively change the procedure, which improve filter clearing or which reduce contamination problems in a laboratory are permitted.

a. Use only TEM grids that have had grid opening areas measured according to directions in Unit III.J.

b. Remove the inlet and outlet plugs prior to opening the cassette to minimize any pressure differential that may be present.

c. Examples of techniques used to prepare polycarbonate filters are described in Unit III.F.7.

d. Examples of techniques used to prepare mixed cellulose ester filters are described in Unit III.F.8.

e. Prepare multiple grids for each sample.

f. Store the three grids to be measured in appropriately labeled grid holders or polyethylene capsules.

5. Equipment.

a. Clean area.

b. Tweezers. Fine-point tweezers for handling of filters and TEM grids.

c. Scalpel Holder and Curved No. 10 Surgical Blades.

d. Microscope slides.

e. Double-coated adhesive tape.

f. Gummed page reinforcements.

g. Micro-pipet with disposal tips 10 to 100 μL variable volume.

h. Vacuum coating unit with facilities for evaporation of carbon. Use of a liquid nitrogen cold trap above the diffusion pump will minimize the possibility of contamination of the filter surface by oil from the pumping system. The vacuum-coating unit can also be used for deposition of a thin film of gold.

i. Carbon rod electrodes. Spectrochemically pure carbon rods are required for use in the vacuum evaporator for carbon coating of filters.

j. Carbon rod sharpener. This is used to sharpen carbon rods to a neck. The use of necked carbon rods (or equivalent) allows the carbon to be applied to the filters with a minimum of heating.

k. Low-temperature plasma asher. This is used to etch the surface of collapsed mixed cellulose ester (MCE) filters. The asher should be supplied with oxygen, and should be modified as necessary to provide a throttle or bleed valve to control the speed of the vacuum to minimize disturbance of the filter. Some early models of ashers admit air too rapidly, which may disturb particulates on the surface of the filter during the etching step.

l. Glass petri dishes, 10 cm in diameter, 1 cm high. For prevention of excessive evaporation of solvent when these are in use, a good seal must be provided between the base and the lid. The seal can be improved by grinding the base and lid together with an abrasive grinding material.

m. Stainless steel mesh.

n. Lens tissue.

o. Copper 200-mesh TEM grids, 3 mm in diameter, or equivalent.

p. Gold 200-mesh TEM grids, 3 mm in diameter, or equivalent.

q. Condensation washer.

r. Carbon-coated, 200-mesh TEM grids, or equivalent.

s. Analytical balance, 0.1 mg sensitivity.

t. Filter paper, 9 cm in diameter.

u. Oven or slide warmer. Must be capable of maintaining a temperature of 65–70 °C.

v. Polyurethane foam, 6 mm thickne

w. Gold wire for evaporation.

6. Reagents.

a. General. A supply of ultra-clean, fiber-free water must be available for washing of all components used in the analysis. Water that has been distilled in glass or filtered or deionized water is satisfactory for this purpose. Reagents must be fiber-free.

b. Polycarbonate preparation method—chloroform.

c. Mixed Cellulose Ester (MCE) preparation method—acetone or the Burdette procedure (Ref. 7 of Unit III.L.).

7. TEM specimen preparation from polycarbonate filters.

a. Specimen preparation laboratory. It is most important to ensure that contamination of TEM specimens by extraneous asbestos fibers is minimized during preparation.

b. Cleaning of sample cassettes. Upon receipt at the analytical laboratory and before they are taken into the clean facility or laminar flow hood, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces.

c. Preparation of the carbon evaporator. If the polycarbonate filter has already been carbon-coated prior to receipt, the carbon coating step will be omitted, unless the analyst believes the carbon film is too thin. If there is a need to apply more carbon, the filter will be treated in the same way as an uncoated filter. Carbon coating must be performed with a high-vacuum coating unit. Units that are based on evaporation of carbon filaments in a vacuum generated only by an oil rotary pump have not been evaluated for this application, and must not be used. The carbon rods should be sharpened by a carbon rod sharpener to necks of about 4 mm long and 1 mm in diameter. The rods are installed in the evaporator in such a manner that the points are approximately 10 to 12 cm from the surface of a microscope slide held in the rotating and tilting device.

d. Selection of filter area for carbon coating. Before preparation of the filters, a 75 mm x 50 mm microscope slide is washed and dried. This slide is used to support strips of filter during the carbon evaporation. Two parallel strips of double-sided adhesive tape are applied along the length of the slide. Polycarbonate filters are easily stretched during handling, and cutting of areas for further preparation must be performed with great care. The filter and the MCE backing filter are removed together from the cassette and place a cleaned glass microscope slide. The filter can be cut with a curved scalpel blade by rocking the blade from the

point placed in contact with the filter. The process can be repeated to cut a strip approximately 3 mm wide across the diameter of the filter. The strip of polycarbonate filter is separated from the corresponding strip of backing filter and carefully placed so that it bridges the gap between the adhesive tape strips on the microscope slide. The filter strip can be held with fine-point tweezers and supported underneath by the scalpel blade during placement on the microscope slide. The analyst can place several such strips on the same microscope slide, taking care to rinse and wet-wipe the scalpel blade and tweezers before handling a new sample. The filter strips should be identified by etching the glass slide or marking the slide using a marker insoluble in water and solvents. After the filter strip has been cut from each filter, the residual parts of the filter must be returned to the cassette and held in position by reassembly of the cassette. The cassette will then be archived for a period of 30 days or returned to the client upon request.

e. Carbon coating of filter strips. The glass slide holding the filter strips is placed on the rotation-tilting device, and the evaporator chamber is evacuated. The evaporation must be performed in very short bursts, separated by some seconds to allow the electrodes to cool. If evaporation is too rapid, the strips of polycarbonate filter will begin to curl, which will lead to cross-linking of the surface material and make it relatively insoluble in chloroform. An experienced analyst can judge the thickness of carbon film to be applied, and some test should be made first on unused filters. If the film is too thin, large particles will be lost from the TEM specimen, and there will be few complete and undamaged grid openings on the specimen. If the coating is too thick, the filter will tend to curl when exposed to chloroform vapor and the carbon film may not adhere to the support mesh. Too thick a carbon film will also lead to a TEM image that is lacking in contrast, and the ability to obtain ED patterns will be compromised. The carbon film should be as thin as possible and remain intact on most of the grid openings of the TEM specimen intact.

f. Preparation of the Jaffe washer. The precise design of the Jaffe washer is not considered important, so any one of the published designs may be used. A washer consisting of a simple stainless steel bridge is recommended. Several pieces of lens tissue approximately 1.0 cm x 0.5 cm are placed on the stainless steel bridge, and the washer is filled with chloroform to a level where the meniscus contacts the underside of the mesh, which results in saturation of the lens tissue. See References 8 and 10 of Unit III.L.

g. Placing of specimens into the Jaffe washer. The TEM grids are first placed on a piece of lens tissue so that individual grids can be picked up with tweezers. Using a curved scalpel blade, the analyst excises three 3 mm square pieces of the carbon-coated polycarbonate filter from the filter strip. The three squares are selected from the center of the strip and from two points between the outer periphery of the active surface and the center. The piece of filter is placed on a TEM specimen grid with the shiny side of the TEM grid facing upwards, and the whole assembly is placed boldly onto the saturated lens tissue in the Jaffe washer. If carbon-coated grids are used, the filter should be placed carbon-coated side down. The three excised squares of filters are placed on the same piece of lens tissue. Any number of separate pieces of lens tissue may be placed in the same Jaffe washer. The lid is then placed on the Jaffe washer, and the system is allowed to stand for several hours, preferably overnight.

h. *Condensation washing. It has been* found that many polycarbonate filters will not dissolve completely in the Jaffe washer, even after being exposed to chloroform for as long as 3 days. This problem becomes more serious if the surface of the filter was overheated during the carbon evaporation. The presence of undissolved filter medium on the TEM preparation leads to partial or complete obscuration of areas of the sample, and fibers that may be present in these areas of the specimen will be overlooked; this will lead to a low result. Undissolved filter medium also compromises the ability to obtain ED patterns. Before they are counted, TEM grids must be examined critically to determine whether they are adequately cleared of residual filter medium. It has been found that condensation washing of the grids after the initial Jaffe washer treatment, with chloroform as the solvent, clears all residual filter medium in a period of approximately 1 hour. In practice, the piece of lens tissue supporting the specimen grids is transferred to the cold finger of the condensation washer, and the washer is operated for about 1 hour. If the specimens are cleared satisfactorily by the Jaffe washer alone, the condensation washer step may be unnecessary.

8. TEM specimen preparation from MCE filters.

a. This method of preparing TEM specimens from MCE filters is similar to that specified in NIOSH Method 7402. See References 7, 8, and 9 of Unit III.L.

b. Upon receipt at the analytical laboratory, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces before entering the clean sample preparation area.

c. Remove a section from any quadrant of the sample and blank filters.

d. Place the section on a clean microscope slide. Affix the filter section to the slide with a gummed paged reinforcement or other suitable means. Label the slide with a water and solvent-proof marking pen.

e. Place the slide in a petri dish which contains several paper filters soaked with 2 to 3 mL acetone. Cover the dish. Wait 2 to 4 minutes for the sample filter to fuse and clear.

f. Plasma etching of the collapsed filter is required.

i. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the conditions that should be used. This is one area of the method that requires *further evaluation. Insufficient etching* will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for a particular asher and operating conditions will then be set such that a 1-2 μm (10 percent) layer of collapsed surface will be removed.

ii. Place the slide containing the collapsed filters into a low-temperature plasma asher, and etch the filter.

g. Transfer the slide to a rotating stage inside the bell jar of a vacuum evaporator. Evaporate a 1 mm x 5 mm section of graphite rod onto the cleared filter. Remove the slide to a clean, dry, covered petri dish.

h. Prepare a second petri dish as a Jaffe washer with the wicking substrate prepared from filter or lens paper placed on top of a 6 mm thick disk of clean spongy polyurethane foam. Cut a V-notch on the edge of the foam and filter paper. Use the V notch as a reservoir for adding solvent. The wicking substrate should be thin enough to fit into the petri dish without touching the lid.

i. Place carbon-coated TEM grids face up on the filter or lens paper. Label the grids by marking with a pencil on the filter paper or by putting registration

marks on the petri dish lid and marking with a waterproof marker on the dish lid. In a fume hood, fill the dish with acetone until the wicking substrate is saturated. The level of acetone should be just high enough to saturate the filter paper without creating puddles.

j. Remove about a quarter section of the carbon-coated filter samples from the glass slides using a surgical knife and tweezers. Carefully place the section of the filter, carbon side down, on the appropriately labeled grid in the acetone-saturated petri dish. When all filter sections have been transferred, slowly add more solvent to the wedge-shaped trough to bring the acetone level up to the highest possible level without disturbing the sample preparations. Cover the petri dish. Elevate one side of the petri dish by placing a slide under it. This allows drops of condensed solvent vapors to form near the edge rather than in the center where they would drip onto the grid preparation.

G. TEM Method

1. Instrumentation.

a. Use an 80–120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm in diameter at crossover. The microscope shall be calibrated routinely (see Unit III.J.) for magnification and camera constant.

b. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory. This must be an Energy Dispersive X-ray Detector mounted on TEM column and associated hardware/software to collect, save read out spectral information. Calibration of Multi-Channel Analyzer shall be checked regularly for Al at 1.48 KeV and Cu at 8.04 KeV, as well as the manufacturer's procedures.

i. Standard replica grating may be used to determine magnification (e.g., 2160 lines/mm).

ii. Gold standard may be used to determine camera constant.

c. Use a specimen holder with single tilt and/or double tilt capabilities.

2. Procedure.

a. Start a new Count Sheet for each sample to be analyzed. Record on count sheet: analyst's initials and date; lab sample number; client sample number microscope identification; magnification for analysis; number of predetermined grid openings to be analyzed; and grid identification. See the following Figure 4:

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FIGURE 4--COUNT SHEET

Lab Sample No. _____ Filter Type _____ Operator _____
Client Sample No. _____ Filter Area _____ Date _____
Instrument I.D. _____ Grid I.D. _____ Comments _____
Magnification _____ Grid Opening (GO) Area _____ _____
Acc. Voltage _____ No. GO to be Analyzed _____ _____

GO	Structure No.	Structure Type*	Length		ED Observation				EDAX
			< 5μm	≥ 5 μm	Chrys.	Amph.	Nonasb.	Neg. ID	

GO	Structure No.	Structure Type*	Length		ED Observation				EDAX
			< 5μm	≥ 5 μm	Chrys.	Amph.	Nonasb.	Neg. ID	

*B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD = No fibers detected
N = No diffraction obtained

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b. Check that the microscope is properly aligned and calibrated according to the manufacturer's specifications and instructions.

c. Microscope settings: 80–120 kV, grid assessment 250–1000X, then 15,000–20,000X screen magnification for analysis.

d. Approximately one-half (0.5) of the predetermined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample grid preparation.

e. Determine the suitability of the grid.

i. Individual grid openings with greater than 5 percent openings (holes) or covered with greater than 25 percent particulate matter or obviously having nonuniform loading shall not be analyzed.

ii. Examine the grid at low magnification (<1000X) to determine its suitability for detailed study at higher magnifications.

iii. Reject the grid if:

(1) Less than 50 percent of the grid openings covered by the replica are intact.

(2) It is doubled or folded.

(3) It is too dark because of incomplete dissolution of the filter.

iv. If the grid is rejected, load the next sample grid.

v. If the grid is acceptable, continue on to Step 6 if mapping is to be used; otherwise proceed to Step 7.

f. Grid Map (Optional).

i. Set the TEM to the low magnification mode.

ii. Use flat edge or finder grids for mapping.

iii. Index the grid openings (fields) to be counted by marking the acceptable fields for one-half (0.5) of the area needed for analysis on each of the two grids to be analyzed. These may be marked just before examining each grid opening (field), if desired.

iv. Draw in any details which will allow the grid to be properly oriented if it is reloaded into the microscope and a particular field is to be reliably identified.

g. Scan the grid.

i. Select a field to start the examination.

ii. Choose the appropriate magnification (15,000 to 20,000X screen magnification).

iii. Scan the grid as follows.

(1) At the selected magnificati make a series of parallel traverse across the field. On reaching the end of one traverse, move the image one window and reverse the traverse.

Note.—A slight overlap should be used so as not to miss any part of the grid opening (field).

(2) Make parallel traverses until the entire grid opening (field) has been scanned.

h. Identify each structure for appearance and size.

i. Appearance and size: Any continuous grouping of particles in which an asbestos fiber within aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm i detected shall be recorded on the coun sheet. These will be designated asbest structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are t be described as cluster or matrix. See the following Figure 5:

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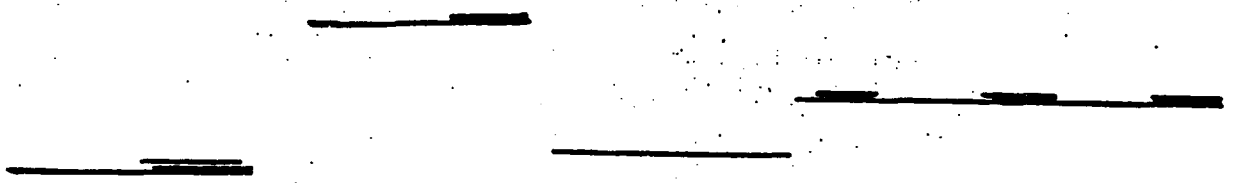
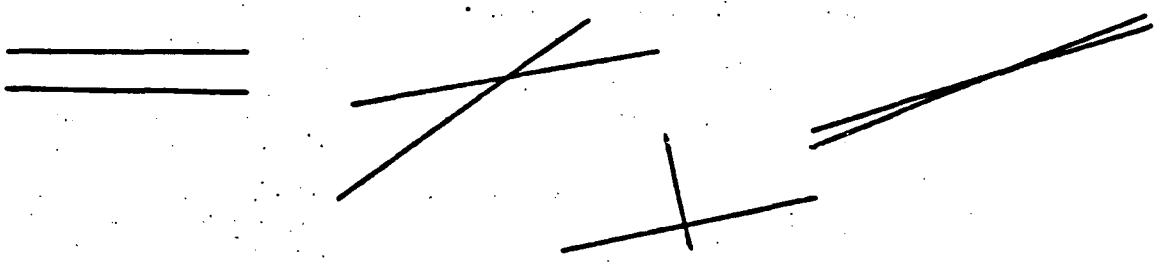
FIGURE 5--COUNTING GUIDELINES USED IN DETERMINING ASBESTOS STRUCTURES

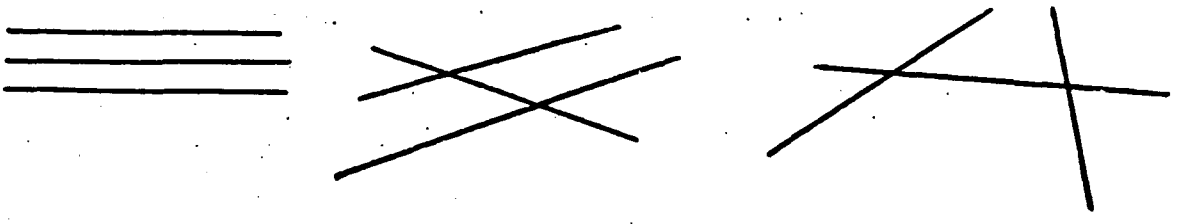
Count as 1 fiber; 1 Structure; no intersections.



Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.

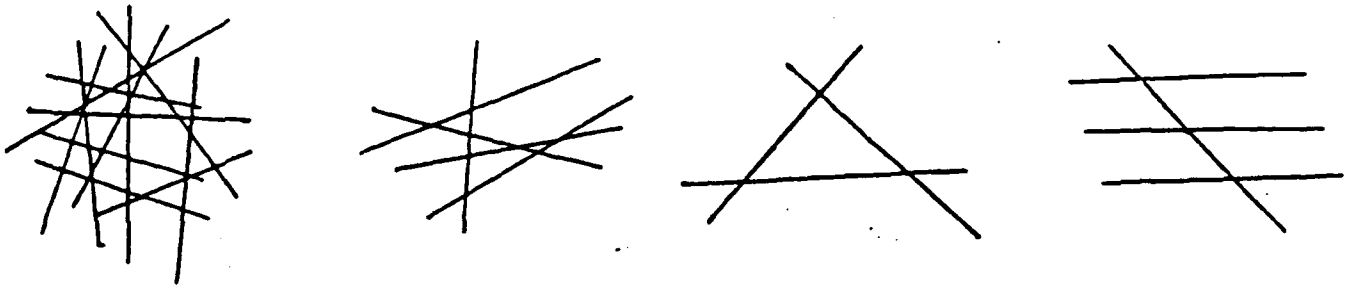


Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.

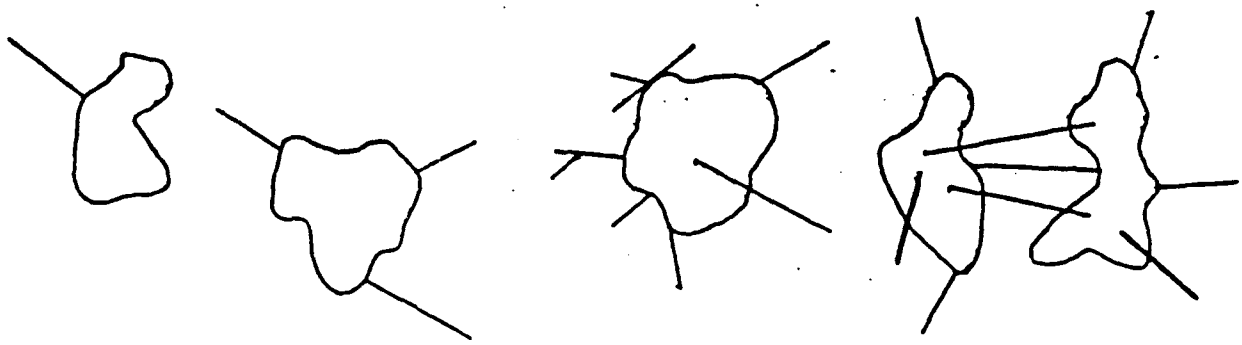


Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.

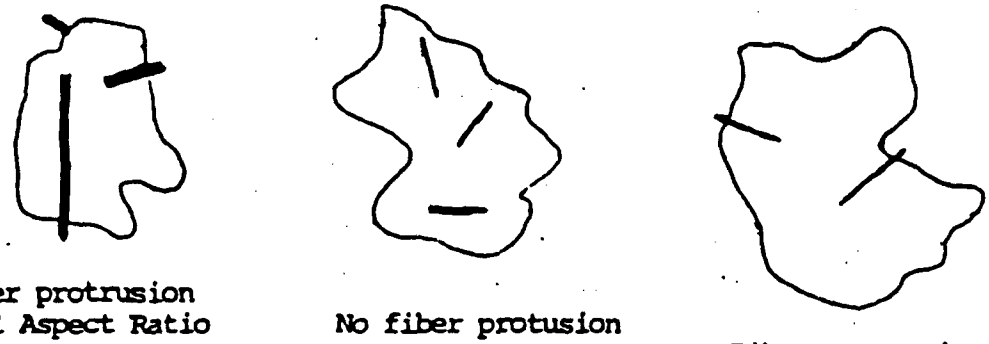
Count clusters as 1 structure; fibers having greater than or equal to 3 intersections.



Count matrix as 1 structure.



DO NOT COUNT AS STRUCTURES:



Fiber protrusion <5:1 Aspect Ratio

No fiber protusion

Fiber protrusion <0.5 micrometer

—— <0.5 micrometer in length
— <5:1 Aspect Ratio

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An intersection is a non-parallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. Combinations such as a matrix and cluster, matrix and bundle, or bundle and cluster are categorized by the dominant fiber quality—cluster, bundle, and matrix, respectively. Separate categories will be maintained for fibers less than 5 μm and for fibers greater than or equal to 5 μm in length. Not required, but useful, may be to record the fiber length in 1 μm intervals. (Identify each structure morphologically and analyze it as it enters the "window".)

(1) *Fiber.* A structure having a minimum length greater than 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed, no intersections.

(2) *Bundle.* A structure composed of 3 or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

(3) *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings must have more than 2 intersections.

(4) *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

(5) *NSD.* Record NSD when no structures are detected in the field.

(6) *Intersection.* Non-parallel touching or crossing of fibers, with the projection having an aspect ratio 5:1 or greater.

ii. Structure Measurement.

(1) Recognize the structure that is to be sized.

(2) Memorize its location in the "window" relative to the sides, inscribed square and to other particulates in the field so this exact location can be found again when scanning is resumed.

(3) Measure the structure using the scale on the screen.

(4) Record the length category and structure type classification on the count sheet after the field number and fiber number.

(5) Return the fiber to its original location in the window and scan the rest of the field for other fibers; if the direction of travel is not remembered, return to the right side of the field and begin the traverse again.

i. Visual identification of Electron Diffraction (ED) patterns is required for each asbestos structure counted which would cause the analysis to exceed the 70 s/mm^2 concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

i. Center the structure, focus, and obtain an ED pattern. (See Microscope Instruction Manual for more detailed instructions.)

ii. From a visual examination of the ED pattern, obtained with a short camera length, classify the observed structure as belonging to one of the following classifications: chrysotile, amphibole, or nonasbestos.

(1) Chrysotile: The chrysotile asbestos pattern has characteristic streaks on the layer lines other than the central line and some streaking also on the central line. There will be spots of normal sharpness on the central layer line and on alternate lines (2nd, 4th, etc.). The repeat distance between layer lines is 0.53 nm and the center doublet is at 0.73 nm. The pattern should display (002), (110), (130) diffraction maxima; distances and geometry should match a chrysotile pattern and be measured semiquantitatively.

(2) Amphibole Group [includes grunerite (amosite), crocidolite, anthophyllite, tremolite, and actinolite]: Amphibole asbestos fiber patterns show layer lines formed by very closely spaced dots, and the repeat distance between layer lines is also about 0.53 nm. Streaking in layer lines is occasionally present due to crystal structure defects.

(3) Nonasbestos: Incomplete or unobtainable ED patterns, a nonasbestos EDXA, or a nonasbestos morphology.

iii. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns. In the event that examination of the pattern by the qualified individual indicates that the pattern had been misidentified visually, the client shall be contacted. If the pattern is a suspected chrysotile, take a photograph of the diffraction pattern at 0 degrees tilt. If the structure is suspected to be amphibole, the sample may have to be tilted to obtain a simple geometric array of spots.

j. Energy Dispersive X-Ray Analysis (EDXA).

i. Required of all amphiboles which would cause the analysis results to exceed the 70 s/mm^2 concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

ii. Can be used alone to confirm chrysotile after the 70 s/mm^2 concentration has been exceeded.

iii. Can be used alone to confirm all nonasbestos.

iv. Compare spectrum profiles with profiles obtained from asbestos standards. The closest match identifies and categorizes the structure.

v. If the EDXA is used for confirmation, record the properly labeled spectrum on a computer disk, or if a hard copy, file with analysis data.

vi. If the number of fibers in the nonasbestos class would cause the analysis to exceed the 70 s/mm^2 concentration, their identities must be confirmed by EDXA or measurement of a zone axis diffraction pattern to establish that the particles are nonasbestos.

k. Stopping Rules.

i. If more than 50 asbestiform structures are counted in a particular grid opening, the analysis may be terminated.

ii. After having counted 50 asbestiform structures in a minimum of 4 grid openings, the analysis may be terminated. The grid opening in which the 50th fiber was counted must be completed.

iii. For blank samples, the analysis is always continued until 10 grid openings have been analyzed.

iv. In all other samples the analysis shall be continued until an analytical sensitivity of 0.005 s/cm^2 is reached.

l. Recording Rules. The count sheet should contain the following information:

i. Field (grid opening): List field number.

ii. Record "NSD" if no structures are detected.

iii. Structure information.

(1) If fibers, bundles, clusters, and/or matrices are found, list them in consecutive numerical order, starting over with each field.

(2) Length. Record length category of asbestos fibers examined. Indicate if less than 5 μm or greater than or equal to 5 μm.

(3) Structure Type. Positive identification of asbestos fibers is required by the method. At least one diffraction pattern of each fiber type from every five samples must be recorded and compared with a standard diffraction pattern. For each asbestos fiber reported, both a morphological descriptor and an identification descriptor shall be specified on the count sheet.

(4) Fibers classified as chrysotile must be identified by diffraction and/or X-ray analysis and recorded on the count

sheet. X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.

(5) Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.)

(6) If a diffraction pattern was recorded on film, the micrograph number must be indicated on the count sheet.

(7) If an electron diffraction was attempted and an appropriate spectra is not observed, N should be recorded on the count sheet.

(8) If an X-ray analysis is attempted but not observed, N should be recorded on the count sheet.

(9) If an X-ray analysis spectrum is stored, the file and disk number must be recorded on the count sheet.

m. Classification Rules.

i. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

iv. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

v. *NSD.* Record NSD when no structures are detected in the field.

n. After all necessary analyses of a particle structure have been completed, return the goniometer stage to 0 degrees, and return the structure to its original location by recall of the original location.

o. Continue scanning until all the structures are identified, classified and sized in the field.

p. Select additional fields (grid openings) at low magnification; scan at a chosen magnification (15,000 to 20,000X screen magnification); and analyze until the stopping rule becomes applicable.

q. Carefully record all data as they are being collected, and check for accura

r. After finishing with a grid, remov from the microscope, and replace it in the appropriate grid hold. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

H. Sample Analytical Sequence

1. Carry out visual inspection of work site prior to air monitoring.

2. Collect a minimum of five air samples inside the work site and five samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

3. Analyze the abatement area samples according to this protocol. The analysis must meet the 0.005 s/cm³ analytical sensitivity.

4. Remaining steps in the analytical sequence are contained in Unit IV. of this Appendix.

I. Reporting

The following information must be reported to the client. See the following Table II:

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TABLE II--EXAMPLE LABORATORY LETTERHEAD

Laboratory I.D.	Client I.D.	FILTER MEDIA DATA				Analyzed Area, mm^2	Sample Volume, cc
		Type	Diameter, mm	Effective Area, mm^2	Pore Size, µm		

INDIVIDUAL ANALYTICAL RESULTS

Laboratory I.D.	Client I.D.	# Asbestos Structures	Analytical Sensitivity, s/cc	CONCENTRATION	
				Structures/mm^2	Structures/cc

The analysis was carried out to the approved TEM method. This laboratory is in compliance with the quality specified by the method.

Authorized Signature

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1. Concentration in structures per square millimeter and structures per cubic centimeter.
2. Analytical sensitivity used for the analysis.
3. Number of asbestos structures.
4. Area analyzed.
5. Volume of air samples (which was initially provided by client).
6. Average grid size opening.
7. Number of grids analyzed.
8. Copy of the count sheet must be included with the report.
9. Signature of laboratory official to indicate that the laboratory met specifications of the AHERA method.
10. Report form must contain official laboratory identification (e.g., letterhead).
11. Type of asbestos.

J. Calibration Methodology

Note: Appropriate implementation of the method requires a person knowledgeable in electron diffraction and mineral identification by ED and EDXA. Those inexperienced laboratories wishing to develop capabilities may acquire necessary knowledge through analysis of appropriate standards and by following detailed methods as described in References 8 and 10 of Unit III.L.

1. Equipment Calibration. In this method, calibration is required for the air-sampling equipment and the transmission electron microscope (TEM).

a. TEM Magnification. The magnification at the fluorescent screen of the TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica. A logbook must be maintained, and the dates of calibration depend on the past history of the particular microscope; no frequency is specified. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate an eucentric tilting specimen stage, all speciments and the cross grating replica must be placed at the eucentric position.

b. Determination of the TEM magnification on the fluorescent screen.

i. Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

ii. Insert a diffraction grating replica (for example a grating containing 2,160 lines/mm) into the specimen holder and place into the microscope. Orient the replica so that the grating lines fall perpendicular to the scale on the TEM fluorescent screen. Ensure that the goniometer stage tilt is 0 degrees.

iii. Adjust microscope magnification to 10,000X or 20,000X. Measure the distance (mm) between two widely separated lines on the grating replica. Note the number of spaces between the lines. Take care to measure between the same relative positions on the lines (e.g., between left edges of lines).

Note.—The more spaces included in the measurement, the more accurate the final calculation. On most microscopes, however, the magnification is substantially constant only within the central 8–10 cm diameter region of the fluorescent screen.

iv. Calculate the true magnification (M) on the fluorescent screen:

$$M = XG/Y$$

where:
X = total distance (mm) between the designated grating lines;
G = calibration constant of the grating replica (lines/mm):
Y = number of grating replica spaces counted along X.

c. Calibration of the EDXA System. Initially, the EDXA system must be calibrated by using two reference elements to calibrate the energy scale of the instrument. When this has been completed in accordance with the manufacturer's instructions, calibration in terms of the different types of asbestos can proceed. The EDXA detectors vary in both solid angle of detection and in window thickness. Therefore, at a particular accelerating voltage in use on the TEM, the count rate obtained from specific dimensions of fiber will vary both in absolute X-ray count rate and in the relative X-ray peak heights for different elements. Only a few minerals are relevant for asbestos abatement work, and in this procedure the calibration is specified in terms of a "fingerprint" technique. The EDXA spectra must be recorded from individual fibers of the relevant minerals, and identifications are made on the basis of semiquantitative comparisons with these reference spectra.

d. Calibration of Grid Openings.

i. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass slide and examining it under the PCM. Use a calibrated graticule to measure the average field diameter and use this number to calculate the field area f average grid opening. Grids are to be randomly selected from batches up to 1,000.

Note.—A grid opening is considered as one field.

ii. The mean grid opening area must be measured for the type of specimen grids in use. This can be accomplished on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

e. Determination of Camera Constant and ED Pattern Analysis.

i. The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern fr- the polycrystalline gold film.

ii. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulates. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, mulitiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter, D, of the rings times the interplanar spacing, d, of the ring being measured.

K. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filte and the actual examination of this g in the microscope. Each of these unit operations must produce a product of

defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

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TABLE III--SUMMARY OF LABORATORY DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

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1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks and special testing after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If this average is greater than 53 f/mm ^{2} per 10 200-mesh grid openings, check the system for possible sources of contamination.

6. Check for recovery of asbestos from cellulose ester filters submitted to plasma asher.

7. Check for asbestos carryover in the plasma asher by including a blank alongside the positive control sample.

8. Perform a systems check on the transmission electron microscope daily.

9. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III of Unit III.K.

10. Ensure qualified operator performance by evaluation of replicate counting, duplicate analysis, and standard sample comparisons as set forth in Table III of Unit III.K.

11. Validate all data entries.

12. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III.

13. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions.

The outline of quality control procedures presented above is viewed as the minimum required to assure that quality data is produced for clearance testing of an asbestos abated area. Additional information may be gained by other control tests. Specifics on those control procedures and options available for environmental testing can be obtained by consulting References 6, 7, and 11 of Unit III.L.

L. References

For additional background information on this method the following references should be consulted.

1. "Guidelines for Controlling Asbestos-Containing Materials in Buildings." EPA 560/5–85–024, June 1985.

2. "Measuring Airborne Asbestos Following an Abatement Action," USEPA/ Office of Toxic Substances, EPA 600/4–85–049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4–77–027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume Through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J. Health & Safety Exec., Research & Lab. Services Div., London, "Proposed Analytical Method for Determination of Asbestos in Air."

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc. "Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Electron Microscopy Using Polycarbonate Membrane Filters." WERL SOP 87–1, March 5, 1987.

9. NIOSH. Method 7402 for Asbestos Fibers, December 11, 1986 Draft.

10. Yamate, G., S.C. Agarwall, R.D. Gibbons, IIT Research Institute, "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy." Draft report, USEPA Contract 68–02–3266, July 1984.

11. Guidance to the Preparation of Quality Assurance Project Plans. USEPA, Office of Toxic Substances, 1984.

IV. Mandatory Interpretation of Transmission Electron Microscopy Results to Determine Completion of Response Actions

A. Introduction

A response action is determined to be completed by TEM when the abatement area has been cleaned and the airborne asbestos concentration inside the abatement area is no higher than concentrations at locations outside the abatement area. "Outside" means outside the abatement area, but not necessarily outside the building. EPA reasons that an asbestos removal contractor cannot be expected to clean an abatement area to an airborne asbestos concentration that is lower than the concentration of air entering the abatement area from outdoors or from other parts of the building. After the abatement area has passed a thorough visual inspection, and before the outer containment barrier is removed, a minimum of five air samples inside the abatement area and a minimum of five air samples outside the abatement area must be collected. Hence, the response action is determined to be completed when the average airborne asbestos concentration measured inside the abatement area is not statistically different from the average airborne asbestos concentration measured outside the abatement area.

The inside and outside concentrations are compared by the Z-test, a statistical test that takes into account the variability in the measurement process. A minimum of five samples inside the abatement area and five samples outside the abatement area are required to control the *false negative error rate*, i.e., the probability of declaring the removal complete when, in fact, the air concentration inside the abatement area is significantly higher than outside the abatement area. Additional quality control is provided by requiring three blanks (filters through which no air has been drawn) to be analyzed to check for unusually high filter contamination that would distort the test results.

When volumes greater than or equal to 1,199 L for a 25 mm filter and 2,799 L for a 37 mm filter have been collected and the average number of asbestos structures on samples inside the abatement area is no greater than 70 s/mm ^{2} of filter, the response action may be considered complete without comparing the inside samples to the outside samples. EPA is permitting this initial screening test to save analysis costs in situations where the airborne asbestos concentration is sufficiently low so that it cannot be distinguished from the filter contamination/ background level (fibers deposited on the filter that are unrelated to the air being sampled). The screening test cannot be used when volumes of less than 1,199 L for 25 mm filter or 2,799 L for a 37 mm filter are collected because the ability to distinguish levels significantly different from filter background is reduced at low volumes.

The initial screening test is expressed in structures per square millimeter of filter because filter background levels come from sources other than the air being sampled and cannot be meaningfully expressed as a concentration per cubic centimeter of air. The value of 70 s/mm^2 is based on the experience of the panel of microscopists who consider one structure in 10 grid openings (each grid opening with an area of 0.0057 mm^2) to

be comparable with contamination/background levels of blank filters. The decision is based, in part, on Poisson statistics which indicate that four structures must be counted on a filter before the fiber count is statistically distinguishable from the count for one structure. As more information on the performance of the method is collected, this criterion may be modified. Since different combinations of the number and size of grid openings are permitted under the TEM protocol, the criterion is expressed in structures per square millimeter of filter to be consistent across all combinations. Four structures per 10 grid openings corresponds to approximately 70 s/mm^2.

B. Sample Collection and Analysis

1. A minimum of 13 samples is required: five samples collected inside the abatement area, five samples collected outside the abatement area, two field blanks, and one sealed blank.

2. Sampling and TEM analysis must be done according to either the mandatory or nonmandatory protocols in Appendix A. At least 0.057 mm^2 of filter must be examined on blank filters.

C. Interpretation of Results

1. The response action shall be considered complete if either:

a. Each sample collected inside the abatement area consists of at least 1,199 L of air for a 25 mm filter, or 2,799 L of air for a 37 mm filter, and the arithmetic mean of their asbestos structure concentrations per square millimeter of filter is less than or equal to 70 s/mm^2; or

b. The three blank samples have an arithmetic mean of the asbestos structure concentration on the blank filters that is less than or equal to 70 s/mm^2 and the average airborne asbestos concentration measured inside the abatement area is not statistically higher than the average airborne asbestos concentration measured outside the abatement area as determined by the Z-test. The Z-test is carried out by calculating

$$Z = \frac{\bar{Y}_I - \bar{Y}_O}{0.8\left(1/n_I + 1/n_O\right)^{1/2}}$$

where $\bar{Y}_I$ is the average of the natural logarithms of the inside samples and $\bar{Y}_O$ is the average of the natural logarithms of the outside samples, n_I is the number of inside samples and n_O is the number of outside samples. The response action is considered complete if Z is less than or equal to 1.65.

(Note.—When no fibers are counted, the calculated detection limit for that analysis is inserted for the concentration.)

2. If the abatement site does not satisfy either (1) or (2) above, the site must be recleaned and a new set of samples collected.

D. Sequence for Analyzing Samples

It is possible to determine completion of the response action without analyzing all samples. Also, at any point in the process, a decision may be made to terminate the analysis of existing samples, reclean the abatement site, and collect a new set of samples. The following sequence is outlined to minimize the number of analyses needed to reach a decision.

1. Analyze the inside samples.

2. If at least 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for each inside sample and the arithmetic mean concentration of structures per square millimeter of filter is less than or equal to 70 s/mm^2, the response action is complete and no further analysis is needed.

3. If less than 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for any of the inside samples, or the arithmetic mean concentration of structures per square millimeter of filter is greater than 70 s/mm^2, analyze the three blanks.

4. If the arithmetic mean concentration of structures per square millimeter on the blank filters is greater than 70 s/mm^2, terminate the analysis, identify and correct the source of blank contamination, and collect a new set of samples.

5. If the arithmetic mean concentration of structures per square millimeter on the blank filters is less than or equal to 70 s/mm^2, analyze the outside samples and perform the Z-test.

6. If the Z-statistic is less than or equal to 1.65, the response action is complete. If the Z-statistic is greater than 1.65, reclean the abatement site and collect a new set of samples.

Appendix B to Subpart E—Work Practices and Engineering Controls for Small-Scale, Short-Duration Operations Maintenance and Repair (O&M) Activities Involving ACM

This appendix is not mandatory, in that LEAs may choose to comply with all the requirements of 40 CFR 763.121. Section 763.91(b) extends the protection provided by EPA in its 40 CFR 763.121 for worker protection during asbestos abatement projects to employees of local education agencies who perform small-scale, short-duration operations maintenance and repair (O&M) activities involving asbestos-containing materials and are not covered by the OSHA asbestos construction standard at 29 CFR 1926.58 or an asbestos worker protection standard adopted by a State as part of a State plan approved by OSHA under section 18 of the Occupational Safety and Health Act. Employers wishing to be exempt from the requirements of § 763.121 (e)(6) and (f)(2)(i) may instead comply with the provisions of this appendix when performing small-scale, short-duration O&M activities.

Definition of Small-Scale, Short-Duration Activities

For the purposes of this appendix, small-scale, short-duration maintenance activities are tasks such as, but not limited to:

1. Removal of asbestos-containing insulation on pipes.

2. Removal of small quantities of asbestos-containing insulation on beams or above ceilings.

3. Replacement of an asbestos-containing gasket on a valve.

4. Installation or removal of a small section of drywall.

5. Installation of electrical conduits through or proximate to asbestos-containing materials.

Small-scale, short-duration maintenance activities can be further defined, for the purposes of this subpart, by the following considerations:

1. Removal of small quantities of asbestos-containing materials (ACM) only if required in the performance of another maintenance activity not intended as asbestos abatement.

2. Removal of asbestos-containing thermal system insulation not to exceed amounts greater than those which can be contained in a single glove bag.

3. Minor repairs to damaged thermal system insulation which do not require removal.

4. Repairs to a piece of asbestos-containing wallboard.

5. Repairs, involving encapsulation, enclosure or removal, to small amounts of friable asbestos-containing material only if required in the performance of emergency or routine maintenance activity and not intended solely as asbestos abatement. Such work may not exceed amounts greater than those which can be contained in a single prefabricated minienclosure. Such an enclosure shall conform spatially and geometrically to the localized work ar in order to perform its intended containment function.

APPENDIX B
RJ LEE GROUP QUALITY ASSURANCE PLAN

SUMMARY
QUALITY ASSURANCE PLAN

USE OF THE
TRANSMISSION ELECTRON MICROSCOPE
FOR THE
ANALYSIS OF DURABLE FIBERS

RJ Lee Group, Inc.

Headquarters
350 Hochberg Road
Monroeville, Pennsylvania 15146

Berkeley Laboratory
2424 6th Street
Berkeley, California 94710

Washington, D. C. Laboratory
10366 Battleview Parkway
Manassas, VA 22110

Chopra-Lee, Inc.
an RJ Lee Group affiliate
1741 Baseline Road
Grand Island, New York 14072

TABLE OF CONTENTS

1.0 INTRODUCTION

RJ Lee Group, Inc. is a leader in the field of transmission electron microscopic analysis of durable fibers. As pioneers in this technology, RJ Lee Group has developed a strong Quality Assurance and Quality Control program—a program which far exceeds published regulatory requirements. This document is a synopsis of the Plan. Both the Plan and the relevant Standard Operating Procedures contain proprietary information, but are available for inspection at RJ Lee Group, Inc. by appointment.

The transmission electron microscope (TEM) is a powerful tool used for the analysis of a variety of inorganic materials. The high resolution imaging capability of the TEM combined with energy dispersive X-ray spectroscopy (EDS) can provide detailed morphology and elemental composition determinations of the micro-particulates. The electron diffraction mode provides information on the particle's crystal lattice structure. With these three pieces of information, the micro-particulate can be accurately identified. To achieve high quality work using the capabilities of the TEM, consistent and verifiable operational parameters must be attained. These form the basis of a quality assurance program. The QA/QC program in this document describes the criteria and the means by which the quality and accuracy of RJ Lee Group's transmission electron microscopy data is known and how it meets the requirements of its intended use.

RJ Lee Group has built a reputation of respect and trust through accurate and timely analyses. The continued efforts of all our employees are responsible for the delivery of a quality product. These efforts involve identifying the analytical need, making intelligent choices, and then following prescribed procedures. These practices provide our client with meaningful results—results which can be reproduced and are related to standards. RJ Lee Group personnel realize that reliable data are the only acceptable result for all samples submitted to the company.

2.0 ORGANIZATION AND MANAGEMENT

RJ Lee Group has an organizational structure which facilitates the production of reliable analytical results. Individuals are assigned responsibilities within their realm of technical and managerial expertise. They are then given corporate support and authority to perform the duties and functions required to produce precise and accurate data. An outline of the present managerial system is given below.

The work load of RJ Lee Group has been divided among its employees along functional lines. Direct management of sample preparation and analysis is conducted by the Manager, TEM Analysis-Headquarters, the Manager, Berkeley Laboratory, the Manager, Washington, D. C. Laboratory, or the Manager, Chopra-Lee, Inc. each of whom supervises a staff comprising a sample coordinator, a sample preparations specialist, microscopists, and data entry personnel. Staff members have suitable backgrounds and training to effectively execute their responsibilities.

From a Quality Assurance perspective, the operation is overseen by the Manager, Quality Assurance who periodically introduces blind audit samples into the daily routine, reviews the quality control sample results, and authors special reports. He also provides regular monthly reports to management on the effectiveness of the control program and recommends corrective action when this is deemed necessary. In this function, he reports administratively to the Vice President, Operations.

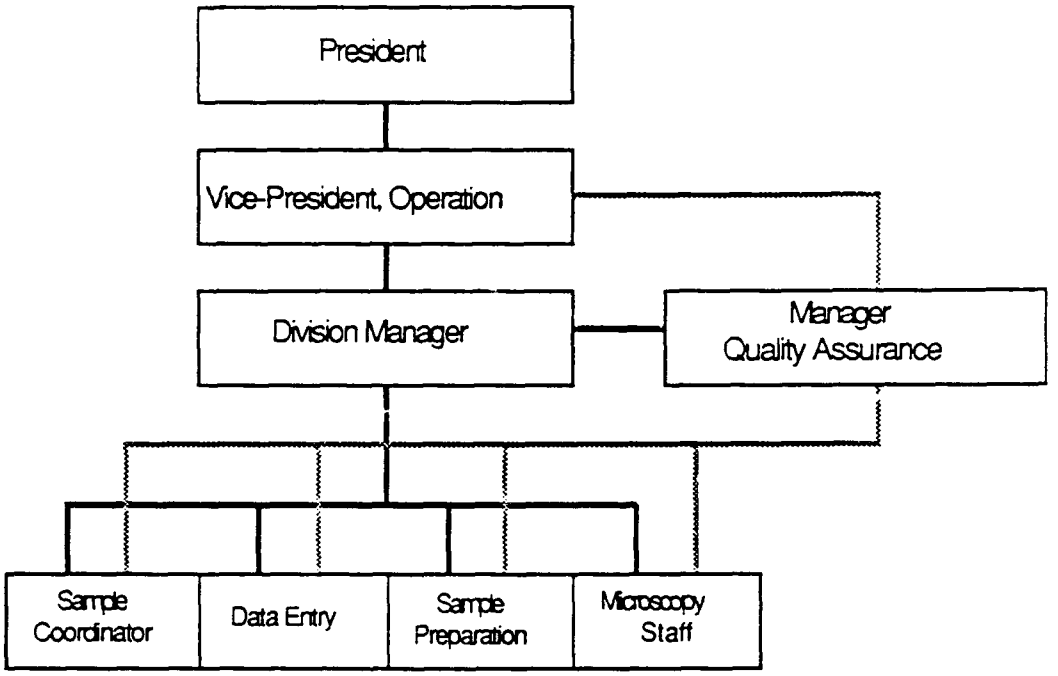

Figure 2.1 RJ Lee Group Project Management Organization Chart for TEM Asbestos Analysis

3.0 PERSONNEL QUALIFICATIONS

The key personnel on RJ Lee Group's roster are technical experts who have years of experience in TEM analytical methodologies. These individuals are nationally recognized for their micro-particulate problem solving abilities.

In addition to a highly qualified focus of key individuals, there is an in-house training program for new employees who have not had experience in asbestos analysis. This training includes a formal introduction to all procedures and instrumentation that will be used by the new employee as well as the theoretical background of the particular analytical method. Following the first phase of instruction, the individual is given extensive on-the-job training by an experienced microscopist with practice samples. This is followed by a series of check sample analyses to establish his or her precision and accuracy. If these are found to be adequate, then the person is phased into analyzing actual samples including a variety of control samples. It is the policy of RJ Lee Group to enroll new microscopists in accredited training courses, when these courses are available.

Vitae of RJ Lee Group management personnel are available upon request.

4.0 FACILITIES, EQUIPMENT, CONSUMABLES AND SERVICES

The RJ Lee Group is headquartered in a 38,000-sq. ft. building located at 350 Hochberg Road, Monroeville, PA. This multi-purpose facility includes electron and optical microscopy laboratories, sample preparation laboratories, metallurgical laboratories, chemistry laboratories,

general office space, conference rooms, and a high bay area. The Berkeley laboratory, opened in 1987, is located at 2424 6th Street in Berkeley, CA. This 6,200-sq. ft. facility includes electron and optical microscopy laboratories. In 1989, RJ Lee Group purchased the Manassas, VA operation of Med-Tox Associates. This new addition to RJ Lee Group is located in a 6,000-sq. ft. facility at 10366 Battlefield Parkway, Manassas, VA. Chopra-Lee Inc., an RJ Lee Group affiliate, was established in 1988 to service western New York and is located at 1741 Baseline Road, Grand Island, NY in a 3,600-sq. ft. facility. All sites are adequately supplied with utilities and services.

All buildings are constructed of masonry block on a slab foundation. There is no spray-on asbestos-containing insulation in either building, or any other immediate source of potential asbestos emissions. The microscope laboratories are located on a slab foundation to ensure a stable, vibration-free base. These facilities are open to government agency or customer inspection when RJ Lee Group personnel are available for such an inspection.

4.1 Clean Room Monitoring

All sample preparation is conducted in a clean room environment monitored by open laboratory blanks. The space must be capable of sustained operation with an open blank, which on subsequent analysis has a concentration of less than 18 structures/mm^2 in an analyzed area of 0.067 mm^2 (nominally ten 200-mesh grid openings). Open blanks are analyzed bi-monthly to assure that the integrity of the environment is maintained.

In addition to room open blanks, each batch of samples is monitored with a sample preparation blank. The sample preparation blank should have a concentration of less than 18 structures/mm^2 in an analyzed area of 0.067 mm^2 (nominally ten 200-mesh grid openings). A single preparation blank is allowed a maximum contamination level of 53 structures/mm^2. A moving sample preparation blank average is monitored as a means for constantly checking the area and providing warning signs of possible contamination.

4.2 Equipment

Data collection and reduction, report writing, and sample tracking are performed on Apple Macintosh™ computer systems.

Four microscopes are available for use in TEM analyses at Monroeville, three are at Berkeley, two in Grand Island, and one in Washington, D. C. Most of the electron microscopes used by RJ Lee Group are state-of-the-art analytical instruments. These are equipped with energy dispersive X-ray analyzers/image processors for rapid analysis of the samples. The X-ray detectors are normally mounted with high take-off angles for optimum signal collection. A partial listing of the major TEM instrumentation follows.

- JEOL JEM 2000FX
- JEOL JEM 1200EX
- JEOL JEM 100-CX II
- Hitachi H-7000
- JEOL JEM 1200EX *(Berkeley)*
- Hitachi H-7000 *(Berkeley)*
- Hitachi HU-12A *(Berkeley)*
- Phillips CM-12 *(Washington, D. C.)*
- Phillips 300 *(Chopra-Lee, Inc.)*
- Hitachi H-600AB *(Chopra-Lee, Inc.)*

All microscopes, X-ray analyzers, and image processing systems are covered by a preventative maintenance program. RJ Lee Group Instrument Services provides most of the routine work necessary to ensure the equipment is fully operational. The equipment is also covered by maintenance agreements with the respective manufacturers. All maintenance performed on the instruments is recorded in log books for each instrument.

4.3 Calibration Procedures and Reference Materials

Calibration is the process of establishing the relationship of a measurement system with that of a known input; it allows different instruments to be correlated with each other and with specified reference standards. Calibration of an analytical TEM is necessary in three instances—magnification, camera constant, and X-ray analysis.

The magnification of the fluorescent screen of the TEM and the true (or camera) magnification must be calibrated monthly (and after servicing or repairs) at the magnification used for fiber counting (15,000 - 20,000X). The dates of calibration and the name of the person performing the calibration are recorded in a logbook.

Selected Area Electron Diffraction (SAED) calibration by gold standard measurement is performed weekly. The camera constant of the TEM must be calibrated before SAED patterns of unknown samples are observed or measured.

The EDS system is calibrated according to manufacturer's specifications. Calibration of the multi-channel analyzer is checked regularly for aluminum at 1.48 Kev and copper at 8.04 Kev. The copper peak is checked daily by verifying that the position markers are in alignment with the centroid of the peak at 8.04 Kev. In addition, NIST SRM 2063 is used to calibrate the EDS system on a weekly basis. Particular attention is paid to the Mg/Fe ratio obtained with the SRM.

TEM grids are calibrated upon receipt at the laboratory using a sophisticated image analysis system.

4.4 Consumables

Laboratory reagents to be used in sample preparation procedures are verified as having acceptable asbestos background levels. Only high-purity analytical grade reagents that conform to purity standards such as ACS Grade (American Chemical Society) are to be used. The chemical supplies and materials used during sample preparation in this operation are checked for their purity, so that when a 150 ml aliquot of the reagent is filtered through a 25 mm filter, the resultant filter has a background level less than 18 s/mm^2 .

4.5 Plasma Etch

Plasma etcher blanks are prepared and analyzed for every twenty (20) samples passing through the asher. The acceptable concentration and action level for asher blanks are the same as for laboratory blanks (<18 s/mm^2).

5.0 DATA GENERATION

The quality of data generated from each sample is dependent upon the quality of sample sent to the laboratory for analysis. Sample collection QA/QC is the responsibility of the field crew. The analytical laboratory has its own unique concerns which relate to the laboratory procedures and equipment employed.

5.1 Sample Receipt

Sample receiving functions are important in qualifying the samples for analysis. Designated sample receivers handle these responsibilities. If samples are received at a time at which the usual designated person is unavailable, a trained assistant or alternate performs these duties, or the samples are held until an authorized person can preview and log them in as required. All samples received at RJ Lee Group are initially processed through a HEPA-filtered hood where each cassette is wet-wiped to prevent contamination of the laboratory. Each sample is assigned a unique laboratory sample number.

If a chain-of-custody form is included, all sample identification information recorded on the chain-of-custody form must be verified with the sample information recorded on the individual sample containers. The individual responsible for the custody of the samples must verify all information prior to signing the chain-of-custody form. The original chain-of-custody form must accompany the shipment of samples and, in like manner, the chain-of-custody form must accompany the samples when returned. The form must contain the name of the individual receiving the samples. Also, all mailing and shipping receipts are kept on file because these become part of the internal laboratory chain-of-custody record.

5.2 Sample Preparation

Cassettes containing filter samples are opened only in the sample preparation area by trained personnel. Here, portions of the exposed filters are cut to grid size. The filter sections are processed, using appropriate techniques, to transfer the materials on the filter to an electron transparent film on the grid for subsequent viewing in the electron microscope. The unused portion of the filter is returned to its cassette which acts as a convenient storage container. These cassettes are carefully archived in secure storage in the event they may be needed for additional filter pieces.

5.3 Analytical Procedures

Various analytical procedures are used in the examination of field samples by the transmission electron microscope (TEM). Choice of technique will depend upon the type of material contained in the field sample (water, bulk, or air particulates) and upon the request of the client. The client's needs are especially important for air particulates since there are two accepted analytical methods for airborne particulates (the so-called Yamate method and the AHERA protocol).

Copies of all analytical procedures can be found in the microscope area. Additional procedures are found in Section 10 of this manual.

Quality Control checks are incorporated in the procedures. Each data set is reviewed prior to reporting to ensure the data complies with the protocol (e.g. ≥5:1 aspect ratio for AHERA, ≥3:1 for EPA, etc).

5.4 Internal Quality Control Checks

Consistently accurate and precise analyses are the result of a series of continual internal quality control checks. Each check is designed to determine the operational capability of the instrumentation and the abilities of the microscopists charged with performing the analyses. These internal checks include the microscope system, microscope alignment, and the microscopists' precision and accuracy.

Operating parameters of the transmission electron microscope are subject to change. The systems of the microscope, the vacuum, lens current, and photographic systems are to be checked daily to maintain consistent analyses. A note is made in the instrument log whenever calibration tests are performed for energy dispersive X ray and magnification checks.

Alignment and stigmation of the TEM is performed daily and with each new microscopist. It is imperative that the electron beam, various apertures, and lenses be in proper alignment to ensure proper illumination, TEM and diffraction functions. Alignment procedures are described in the operations manuals for the respective microscopes.

The primary methods of assessing the precision of the counting abilities of the individual microscopists is through the use of replicate analyses. A replicate analysis is a second (or more) analysis of the same field/fields, performed by the same microscopist as in the original analysis. The microscopist uses the same grid preparation and recounts the same grid openings as originally read. The analyst must check that all operating conditions of the microscope are the same as in the original analysis.

The conformance expectation for this replicate analysis is that the difference in count (per grid opening) from the original and the replicate analyses will fall within one and one-half of the Poisson standard deviation of the average count, or as follows:

$$A_1 - A_2 \leq 1.5 \sqrt{\frac{A_1+A_2}{2}}$$

where A_1 is the original count and A_2 the replicate count. Should difference fall outside the acceptance range, the grid is re-examined to determine the cause of the count variation.

The primary method of determining the accuracy of a microscopist is to duplicate the analysis. A duplicate analysis is performed in a similar manner to the replicate analysis, but with a different microscopist. The second microscopist is randomly selected to perform the analysis. Duplicate analyses are performed once every hundred samples analyzed per microscopist. Conformance expectations are similar to replicate analyses except the difference in counts must fall within two standard deviations, or:

$$A_1 - A_2 \leq 2 \sqrt{\frac{A_1+A_2}{2}}$$

In addition to replicate and duplicate analyses, complete repeat analyses are performed on selected samples. To characterize inter-microscope variability, selected samples are also duplicated (or

replicated) on a microscope other than the one used in the original analyses. Finally, the counting statistics of each microscopist is monitored through the use of verified counting.

New York State Environmental Laboratory Approval Program (ELAP) requires the performance of duplicate analyses once every ten samples (10%). Several other states, in which RJ Lee Group maintains certification, are also developing state-specific requirements. NIST NVLAP program also requires 10% QA work for TEM samples. RJ Lee Group meets or exceeds these requirements.

At least once a year each analyst reads an NIST SRM 1876a or RM 8410 grid. These NIST materials serve as calibration standards for the chrysotile fiber mineralogy in the TEM as well as for an analysis of the microscopists' abilities. This measure gives evidence of interlaboratory comparability and also a measure of accuracy.

Each analyst who has been approved to measure diffraction pattern from micrographs replicates the measurements of previously determined patterns. This occurs once every five samples. Conformance expectations are that the determinations of crystal identity will be identical 90% of the time.

Micrographs are an integral part of all TEM analyses. They are used for recording diffraction patterns and for permanent records of the morphology of individual particles. Because of this importance, each micrograph is sequentially numbered by the microscope. As each micrograph is taken, the number and a description of the micrograph are recorded onto special forms located at each microscope. As the micrographs are developed, they are inserted into numbered sleeves which are also labelled with the microscope designation (eg 1200-EX, or 100-CX).

5.5 Audits

Formal internal systems audits are conducted semi-annually or if significant problems arise in maintaining controlled analyses conditions. The quality assurance coordinator uses a written series of questions and check points for this purpose. He uses this list to grade the laboratory functions and report accordingly. Performance audits using multiple sample preparations from a given grid are made. Audit results will be based on the laboratory response to the reported challenge sample results.

In addition to these internal monitoring activities the laboratory participates in inter-laboratory testing programs. These programs have included methods development exchanges, split sample analyses, and a duplicate testing as part of the NIST NVLAP program. RJ Lee Group has been visited by several audit teams over the last two years. Results of these visits are available upon request.

6.0 DATA PROCESSING

The asbestos analysis protocol sets the form and manner in which the sample information is gathered and processed. Most of the dimensional and morphological data is made by direct observation and then recorded on appropriate laboratory forms. To ensure that all data entries are correctly made, only trained analysts are allowed to file or amend the data for this program. These data entries are reviewed by the analyst before he or she signs off on the data form. Additional

reviews are made as the airborne concentration calculations are performed. A final overview check for consistency is made as the customer report is produced.

Reports are generated at RJ Lee Group using a sophisticated computer database. Calculated results from the database are hand checked once per 100 samples.

7.0 DATA QUALITY ASSESSMENT

The reported results on samples analyzed by transmission electron microscopy will be of known data quality through the use of parallel control samples and regulated procedures. These controls will be used in the following manner.

7.1 Precision

The precision of a measurement is an indication of how closely a result can be reproduced on subsequent analysis. For Quality Assurance and Control, at least a portion of one (1) in 10 samples is recounted to enable a comparison of counts determined on a given sample. The Quality Control coordinator submits such samples with a request for reanalysis. He compares the results with those previously reported to assess the similarity of the results. It is expected that the counts can be reproduced within proscribed limits of the particular process. If an out-of-control situation arises, two counters will sit side by side through the recounting to resolve the discrepancies

The standard deviation is a useful measure of precision for both repeated counting of the same sample by one or more analyst or for the more complete laboratory preparation precision measure through counting of multiple grid preparations from the same sample. Standard deviations are calculated by the formula as follows:

$$s = \sqrt{\frac{\sum_{i=0}^{n}(X_i - \mu)^2}{n-1}}$$

Where

s	=	standard deviation
X_i	=	individual measurement result
n	=	number of measurements
μ	=	mean of X_i

The range between two measurements can also be used to determine the standard deviation of a process. This is given by:

$$s = \frac{X_1 - X_2}{1.128}$$

The standard deviation of a process is frequently expressed as the coefficient of variation. The CV is simply the relative standard deviation, or the ratio of the standard deviation and the mean.

7.2 Completeness

It is important that the records and files of the work be substantially complete. Efforts are made to review the sampling documentation received. In a like manner all laboratory information and files are reviewed by the analyst and the supervisor for correctness and completeness which should be no less than 95% or corrective actions will be taken. This means that when lesser degrees of completion does occur that the information will be properly noted and due effort will be made to reconcile the situation.

Completeness is determined by:

$$\text{Completeness, \%} = 100\,\frac{D_r}{D_e}$$

where D_r is the quantity of valid data obtained and D_e is the quantity of data scheduled to be collected.

8.0 CORRECTIVE ACTION

All instrumentation used in this QA/QC testing program has criteria specified as acceptable operating parameters. Whenever there is a problem in meeting these criteria, sample analysis is suspended until the unit is aligned or repaired to provide a stabilized condition within the expectations. Major service to the units is made only by authorized individuals. Supervisory personnel check the overall condition of the unit before accepting it back for routine analysis.

Performance checks are made as stated with laboratory blanks, replicate analyses, and known check materials. Should any of these control samples reveal discrepancies, the processing of routine samples is suspended until the cause for the problem is identified and corrected. The identification of the cause may entail the analyses of specially prepared samples such as blanks to retest each of the reagents in the process or evaluate the various work stations in the lab separately.

In spite of the best intentions, clients will have problems/complaints concerning the data, timeliness, documentation, etc. of their samples. Generally, most complaints can and should be handled by the appropriate division Manager. Billing complaints will be handled by the Accounting Department. For those complaints which are not directly either group's responsibility, the Manager, Quality Control will intercede and resolve the problem.

9.0 DOCUMENTATION

The AHERA test procedures in the Federal Register of October 30, 1987 describe the required data documentation which is used for many TEM analyses. RJ Lee Group conforms with all these requirements.

10.0 REFERENCES

1. "Interim Method for Determining Asbestos in Water", Anderson and Long, EPA 600/4-80-005, January 1980.

2. "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", EPA 600/M4-82-020, 1982.

3. "Guidance for Controlling Asbestos-Containing Materials in Building", Appendix M, EPA 560/5-85-024, June, 1985.

4. "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy", Yamate, Agarwa, and Gibbons, EPA Contract 68-02-3266, 1984.

5. "Analytical Method for Determination of Asbestos Fibers in Water," Chatfield and Dillon, EPA Contract 68-03-2717, 1981.

6. Federal Register, Part III, 40 CFR Part 763, "Asbestos Containing Materials in Schools; Final Rules and Notice", October 30, 1987.

7. "Ambient Atmospheres - Determination of Asbestos Fibers", Chatfield, Draft Proposal, ISO/TC 146/SC 3/WG1.

Versar INC

APPENDIX C
FLOOR PLANS, SAMPLING DATA SHEETS, CHAIN OF CUSTODIES, AND ANALYTICAL RESULTS

RJ LeeGroup

The Materials Characterization Specialists

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 28, 1991
RJ LEE GRP. JOB NUMBER: ATW-101056
CLIENT JOB NUMBER: 61.5510.3.1
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ESSENTIAL NOTES AND DISCLAIMERS

1. THE ASBESTOS MINERALS SOUGHT IN EACH SAMPLE INCLUDE CHRYSOTILE (CLINOCHRYSOTILE, ORTHOCHRYSOTILE AND PARACHRYSOTILE), AMOSITE (GRUNERITE AND CUMMINGTONITE), CROCIDOLITE (RIEBECKITE), ANTHOPHYLLITE (ANTHOPHYLLITE AND MAGNESIO-ANTHOPHYLLITE) TREMOLITE AND ACTINOLITE. NAMES GIVEN IN PARENTHESES INDICATE THE PROPER MINERALOGICAL TERM FOR ASBESTOS VARIETIES KNOWN BY AN IMPRECISE NAME. DEFINITIONS USED FOR THE AMPHIBOLES ARE THOSE OF THE INTERNATIONAL MINERALOGICAL ASSOCIATION (1978)

2. ASBESTOS STRUCTURES INCLUDED IN THE STRUCTURE CONCENTRATION AND STRUCTURE DENSITY INCLUDE FIBERS, BUNDLES, CLUSTERS AND MATRICES. SEE DEFINITIONS IN EPA'S AHERA TEM METHOD.

3. THE NUMBER OF STRUCTURES USED IN CALCULATING DETECTION LIMITS MAY VARY DEPENDING UPON THE CLEANLINESS OF FIELD AND SEALED BLANKS AND THE CLEANLINESS OF LABORATORY BLANKS CONTEMPORANEOUS WITH THESE SAMPLES.

4. AIRBORNE MASS CONCENTRATIONS OF ASBESTOS IN NANOGRAMS PER CUBIC METER CAN BE PROVIDED AS NEEDED FOR THESE SAMPLES. THIS STREAMLINED REPORT ONLY INCLUDES STRUCTURE CONCENTRATIONS.

5. SAMPLES WITH A DILUTION FACTOR OTHER THAN 1 HAVE BEEN SUBJECTED TO LOW-TEMPERATURE PLASMA ASHING AND AQUEOUS REDEPOSITION DUE TO PARTICULATE OVERLOAD ON THE ORIGINAL FILTER SURFACE. COMPLEX ASBESTOS STRUCTURES CONSISTING OF MULTIPLE FIBERS MAY HAVE DISAGGREGATED DURING SAMPLE PREPARATION; CONSEQUENTLY ASBESTOS STRUCTURE COUNTS MAY BE BIASED HIGH.

6. TEM COEFFICIENTS OF VARIANCE RANGE FROM APPROXIMATELY 0.5 AT LOW FIBER CONCENTRATIONS TO 0.1 AT HIGH FIBER CONCENTRATIONS.

7. THIS TEST REPORT ONLY RELATES TO THE ITEMS TESTED.

8. THIS REPORT IS NOT VALID UNLESS IT BEARS THE NAME OF A NVLAP-APPROVED SIGNATORY.

9. ANY REPRODUCTION OF THIS DOCUMENT MUST INCLUDE THE ENTIRE DOCUMENT IN ORDER FOR THE REPORT TO BE VALID.

10. NEITHER THE NVLAP ACCREDITATION OF THIS LABORATORY NOR THIS REPORT CAN BE USED TO CLAIM PRODUCT ENDORSEMENT BY NVLAP OR ANY AGENCY OF THE U.S. GOVERNMENT.

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USARC ADDISON
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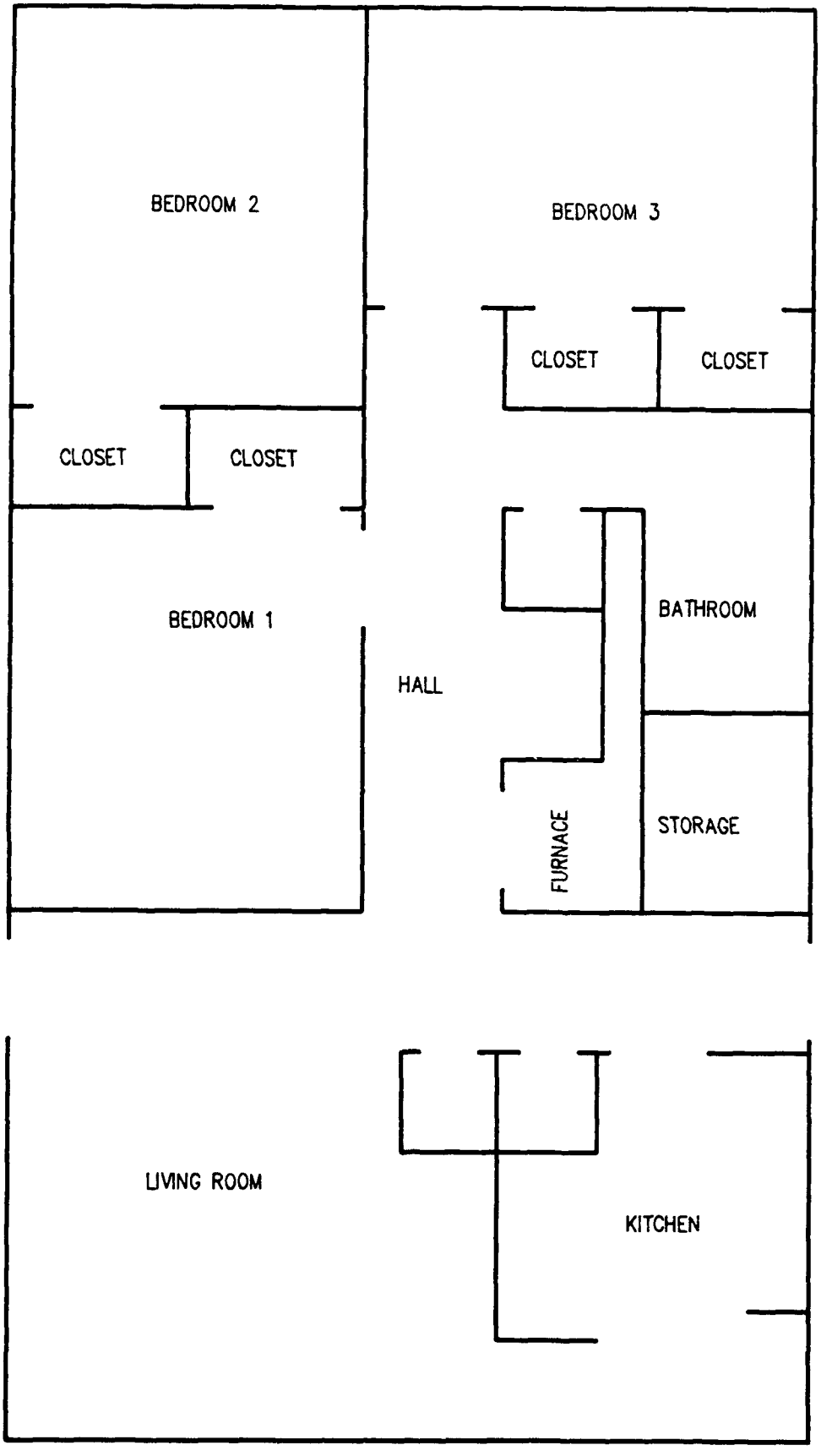
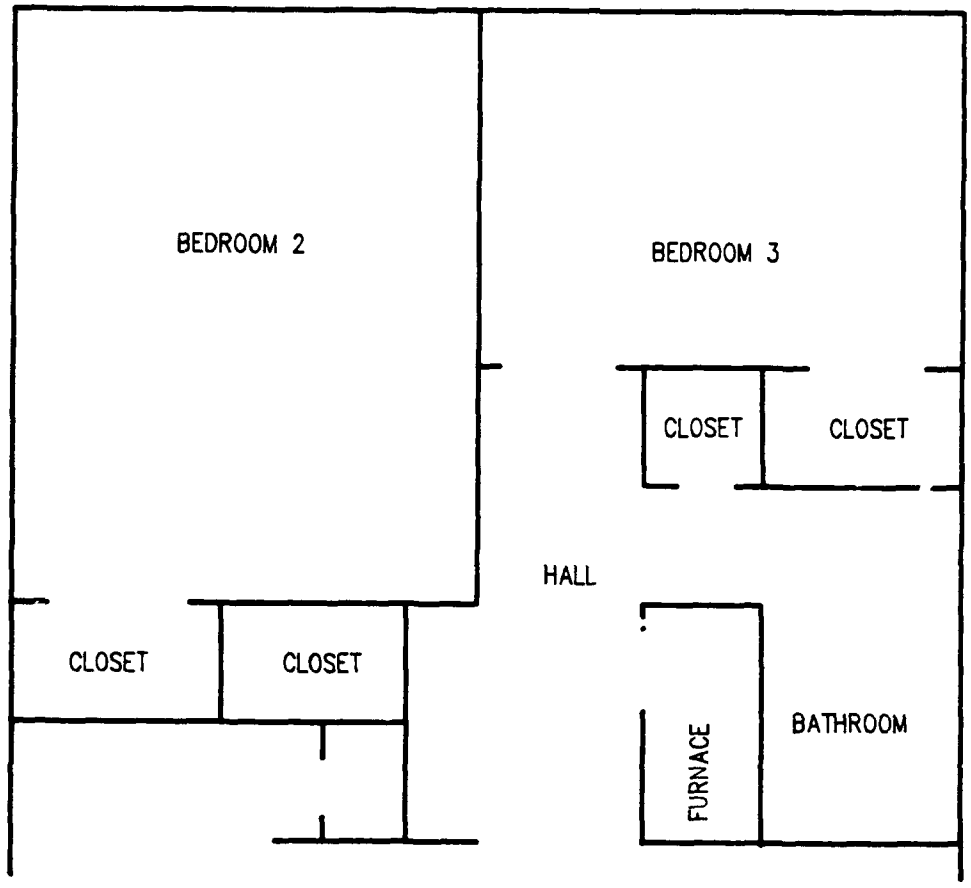
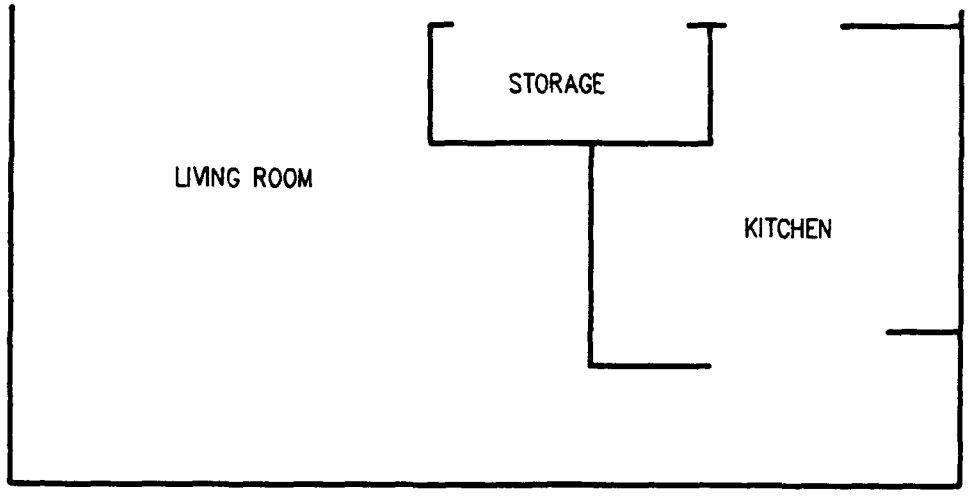


ADDISON FHU
FLOOR PLAN

DRAWING: D:\5510\003.05\PROTO2.DWG PROJECT #: 61.5510.007.00 DATE: 2/25/91





ADDISON FHU
FLOOR PLAN

Wath, IL - 1-28-91

Pump No	Pre-cal	Post/Pre Cal	Post Cal
2466	9.50	9.30 ✓	11.79 > 10.55
2042	9.77	9.75 ✓	9.60 ✓
2043	9765	11.15 > 10.46	9.45 > 10.30
2462	10.12	9.55 > 9.84	10.02 ✓
1667	9.60	9.55 ✓	9.68 ✓
1681	10.25	10.15 ✓	10.33 ✓

Addison 1-29-91

Pump No	Pre-cal	Post/Pre Cal	Pre-cal (lowest pump)	Post Cal
2466	9.998	9.984 ✓		9.23 > 9.61
2042	9.762	8.7 > 9.03	9.953	10.80 > 10.38
2043	9.75	8.63 > 9.19	9.94	10.61 > 10.23
2462	10.03	8.815 > 9.42	10.04	10.67 > 10.36
1667	9.54	9.80 ✓		9.92 ✓
1681	10.14	10.8 ✓		9.4 > 9.85

Addison 1-30-91

Pump No	Pre-Cal	Post-Cal
2466	9.21	9.11 ✓
2042	9.89	9.60 ✓
2043	9.823	9.62 ✓
2462	9.817	9.67 ✓
1667	9.81	9.93 ✓
1681	10.31	10.38 ✓

✓ = okay - within ± 5% of calibrated value - if not use average > for calculation of volume

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
61.5510.003.01	USATHAMA	Y / N

SAMPLERS: (Signature) R. Kyczkowski / A. Olmetti (Printed) R. Kyczkowski / A. Olmetti

PARAMETERS: NO. OF CONTAINERS; Asbestos TEM

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	REMARKS: Flow Rate	REMARKS: Volume
A130-13	1-30-91	9:08 - 11:44			Bathroom #401	9.21 lpm	1436.76
A130-14		9:08 - 11:44			Living room - side	9.89	1542.84
A130-15		9:08 - 11:44			Front bedroom	9.823	1532.39
A130-16		9:08 - 11:44			Living room - back	9.82	1531.92
A130-17		9:02 - 11:45			Outside - front	9.80	1597.40
A130-18		9:02 - 11:45			Outside - front	10.30	1678.90
Blank							

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
R. Kyczkowski	1-30-91	Delores Sparks			
(Printed)		(Printed) 1-31-91 5:45 pm Delores Sparks	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				- use form that reports < ▽ > 5 µ
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
61.5510.003.01	USATHAMA

SAMPLERS: (Signature) R. Kyczkowski / A. Olmetti

(Printed) R. Kyczkowski / A. Olmetti

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	asbestos - TEM	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y/N	REMARKS: Flow Rate	REMARKS: Volume
A129-01	1-29-91	8:52 - 11:40			#403 Living room					9.998 lpm	1679.664
A129-02	1-29-91	8:53 - 11:41			Master bedroom					9.23	1550.64
A129-03	1-29-91	8:52 - 11:41			Bathroom					9.19	1553.11
A129-04	1-29-91	8:53 - 11:41			Front bedroom					9.42	1582.56
A129-05	1-29-91	8:51 - 11:43			Outside front					9.54	1640.88
A129-06	1-29-91	8:51 - 11:43			Outside front					10.14	1744.08
A129-07	1-29-91	12:13 - 3:15			#410 Living room					9.61	1749.02
A129-08	1-29-91	12:16 - 3:17			Master bedroom					10.38	1878.78
A129-09	1-29-91	12:23 - 3:16			Bathroom					10.28	1778.44
A129-10	1-29-91	12:20 - 3:20			Back bedroom					10.36	1864.80
A129-11	1-29-91	12:12 - 3:18			Outside front					9.80	1822.8
A129-12	1-29-91	12:12 - 3:18			Outside front					9.85	1832.10

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
R. Kyczkowski	1-30-91	Delores Sparks			
(Printed)		(Printed) 1-31-91 8:45 AM Delores Sparks	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		- 1 Blank enclosed - use form that reports < or > 5 µ

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

North end Addison, IL

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
ENERGY DISPERSIVE X-RAY ANALYZER :EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILU-TION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 3 : 1, SORTED BY LENGTH < 5.0 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2066163	0.0044	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066164	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066165	0.0045	7	1.0	0.0463	0	0	0	< 21.58	< 0.005	NONE DETECTED
2066166	0.0042	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066167	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066168	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066169	0.0045	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066170	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066171	0.0045	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066172	0.0041	8	1.0	0.0530	1	0	1	18.88	0.004	CHRYSOTILE
2066173	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066174	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066175	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066176	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066177	0.0047	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066178	0.0047	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066179	0.0046	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066180	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066181	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066182	0.0042	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066183	0.0044	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED

North #6
#4
Addison #403 #10

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

North, IL
Addison, IL

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2066163	W-128-01	INSIDE, #6, LIVING ROOM	1643.5	25	50	YES
2066164	W-128-02	INSIDE, #6, BACK CORNER BEDROOM	1709.75	25	50	YES
2066165	W-128-03	INSIDE, #6, MASTER BEDROOM	1830.5	25	50	YES
2066166	W-128-04	INSIDE, #6, BATHROOM	1722	25	50	YES
2066167	W-128-05	OUTSIDE, #6, FRONT	1824.5	25	50	YES
2066168	W-128-06	OUTSIDE, #6, FRONT	1708.8	25	50	YES
2066169	W-128-07	INSIDE, #4, LIVING ROOM	1618.5	25	50	YES
2066170	W-128-08	INSIDE, #4, REAR CENTRAL BEDROOM	1709.8	25	50	YES
2066171	W-128-09	INSIDE, #4, MASTER BEDROOM	1604.4	25	50	YES
2066172	W-128-10	INSIDE, #4, BATHROOM	1772.4	25	50	YES
2066173	W-128-11	OUTSIDE, #4, FRONT	1674.75	25	50	YES
2066174	W-128-12	OUTSIDE, #4, FRONT	1575.75	25	50	YES
2066175	BLANK	BLANK	0	25	50	YES
2066176	A-129-01	INSIDE, #403, LIVING ROOM	1679.664	25	50	YES
2066177	A-129-02	INSIDE, #403, MASTER BEDROOM	1550.64	25	50	YES
2066178	A-129-03	INSIDE, #403, BATHROOM	1553.11	25	50	YES
2066179	A-129-04	INSIDE, #403, FRONT BEDROOM	1582.56	25	50	YES
2066180	A-129-05	OUTSIDE, #403, FRONT	1640.88	25	50	YES
2066181	A-129-06	OUTSIDE, #403, FRONT	1744.08	25	50	YES
2066182	A-129-07	INSIDE, #410, LIVING ROOM	1749.02	25	50	YES
2066183	A-129-08	INSIDE, #410, MASTER BEDROOM	1878.78	25	50	YES

AED
SAMPLE PREPARER

TEG, JPM, TWS, TL, DRM
AED, DHG, RBG, KEI
TEM OPERATOR-ANALYST

Thomas Dagenhart 2-2-91
THOMAS DAGENHART, M.S.
LABORATORY MANAGER
NVLAP SIGNATORY
DATE

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILU-TION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 3 : 1, SORTED BY LENGTH < 5.0 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2066184	0.0041	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066185	0.0045	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2066186	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066187	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066188	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066189	0.0045	9	1.0	0.0596	0	0	0	< 16.78	< 0.004	NONE DETECTED
2066190	0.0042	9	1.0	0.0596	0	0	0	< 16.78	< 0.004	NONE DETECTED
2066191	0.0042	9	1.0	0.0596	0	0	0	< 16.78	< 0.004	NONE DETECTED
2066192	0.0042	9	1.0	0.0596	1	0	1	16.78	0.004	CHRYSOTILE
2066193	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066194	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066195	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Aurora, IL

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2066184	A-129-09	INSIDE, #410, BATHROOM	1778.44	25	50	YES
2066185	A-129-10	INSIDE, #410, BACK BEDROOM	1864.8	25	50	YES
2066186	A-129-11	OUTSIDE, #410, FRONT	1822.8	25	50	YES
2066187	A-129-12	OUTSIDE, #410, FRONT	1832.1	25	50	YES
2066188	BLANK	BLANK	0	25	50	YES
2066189	A-130-13	INSIDE, BATHROOM	1436.76	25	50	YES
2066190	A-130-14	INSIDE, LIVING ROOM SIDE	1542.84	25	50	YES
2066191	A-130-15	INSIDE, FRONT BEDROOM	1532.39	25	50	YES
2066192	A-130-16	INSIDE, LIVING ROOM - BACK	1531.92	25	50	YES
2066193	A-130-17	OUTSIDE, FRONT	1597.4	25	50	YES
2066194	A-130-18	OUTSIDE, FRONT	1678.9	25	50	YES
2066195	BLANK	BLANK	0	25	50	YES

#410

#404

AED
SAMPLE PREPARER

TEG, JPM, TWS, TL, DRM
AED, DHG, RBG, KEI
TEM OPERATOR-ANALYST

Tom Dagenhart 2-2-91
THOMAS DAGENHART, M.S. — DATE
LABORATORY MANAGER
NVLAP SIGNATORY

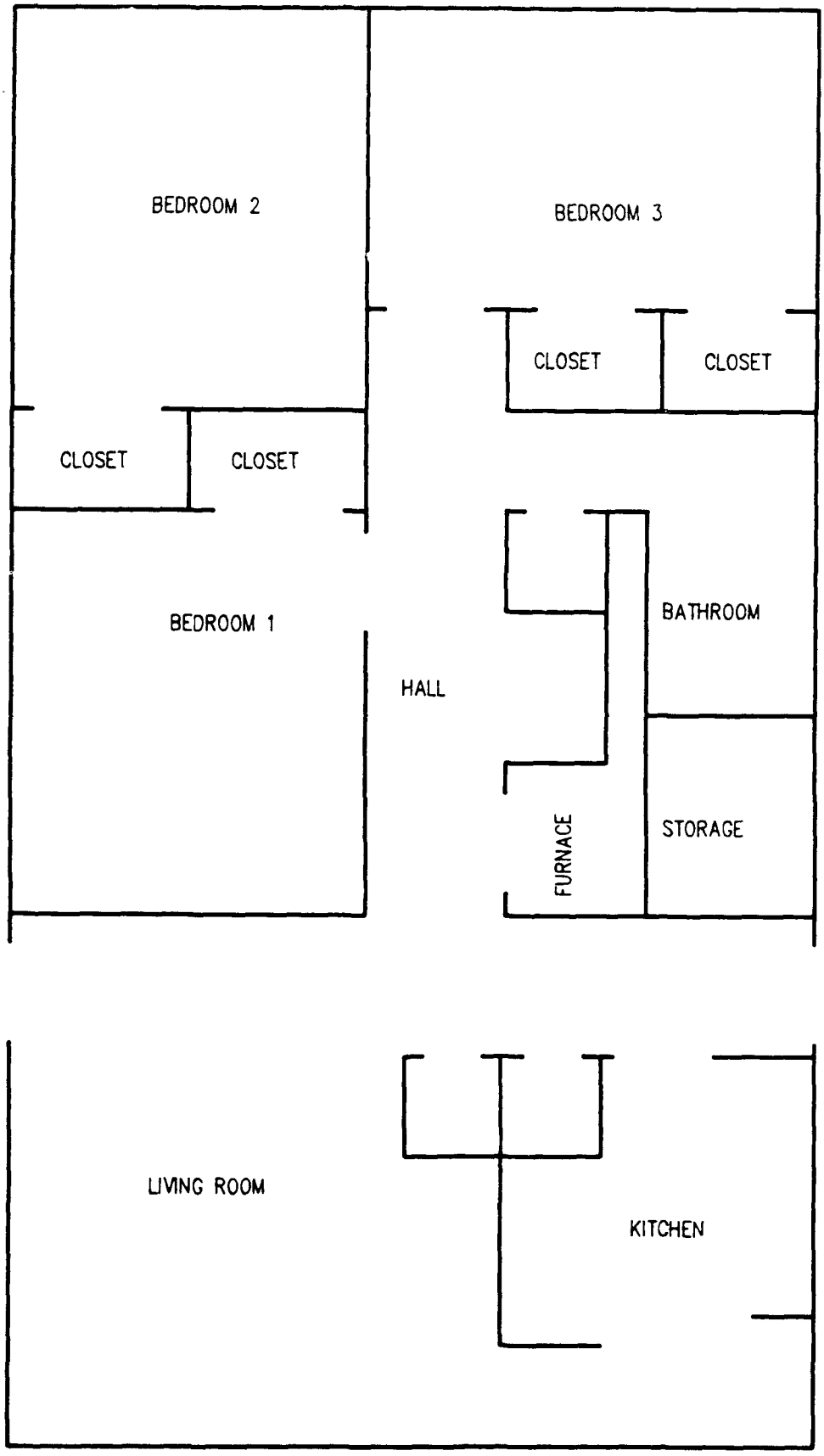
NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

WORTH

WORTH, ILLINOIS



WORTH FHU
FLOOR PLAN

DRAWN: D|\5510\003.05\WORTH02.DWG PROJECT # 61.5510.007.5 DATE: 2/25/91

Wath, IL - 1-28-91

Pump No	Pre-cal	Post/Pre Cal	Post Cal
2466	9.50	9.30 ✓	11.79 > 10.55
2042	9.77	9.75 ✓	9.60 ✓
2043	9765	11.15 > 10.46	9.45 > 10.30
2462	10.12	9.55 > 9.84	10.02 ✓
1667	9.60	9.55 ✓	9.68 ✓
1681	10.25	10.15 ✓	10.33 ✓

Addison 1-29-91

Pump No	Pre-cal	Post/Pre Cal	Pre Cal (Urrest pump)	Post Cal
2466	9.998	9.984 ✓		9.23 > 9.61
2042	9.762	8.7 > 9.23	9.953	10.80 > 10.38
2043	9.75	8.63 > 9.19	9.94	10.61 > 10.23
2462	10.03	8.815 > 9.42	10.04	10.67 > 10.36
1667	9.54	9.80 ✓		9.92 ✓
1681	10.14	10.8 ✓		9.4 > 9.85

Addison 1-30-91

Pump No	Pre-Cal	Post-Cal
2464	9.21	9.11 ✓
2042	9.89	9.60 ✓
2043	9.823	9.62 ✓
2462	9.817	9.67 ✓
1667	9.81	9.93 ✓
1681	10.31	10.38 ✓

✓ = okay - within ± 5% of calibrated value - if not use average for calculation of volume

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y/N
61.5510.003.1	USATHAMA		

SAMPLERS: (Signature) R. Kryczkowski / A. Olmetti (Printed) R. Kryczkowski / A. Olmetti

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBESTOS - TEM	Flow Rate	Volume	REMARKS
W128-01	1-28-91	8:55-11:48			#6 - Living Room			7.50	1643.50	
W128-02	1-28-91	8:55-11:50			Back corner bedroom			9.77	1709.75	
W128-03	1-28-91	8:55-11:50			Master bedroom			10.46	1830.50	
W128-04	1-28-91	8:55-11:50			Bathroom			9.84	1722.00	
W128-05	1-28-91	8:54-11:52			Outside - front			10.25	1834.50	
W128-06	1-28-91	8:54-11:52			Outside - front			9.60	1708.80	
W128-07	1-28-91	12:35-3:21			#4 - Living room			9.75	1618.50	
W128-08	1-28-91	12:34-3:30			Rear central bedroom			10.30	1709.80	
W128-09	1-28-91	12:34-3:22			Master bedroom			9.55	1604.40	
W128-10	1-28-91	12:34-3:22			Bathroom			10.55	1772.40	
W128-11	1-28-91	12:36-3:21			Outside - front			10.15	1674.75	
W128-12	1-28-91	12:36-3:21			Outside - front			9.55	1575.75	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
R. Kryczkowski	1-30-91	Delores Sparks			
(Printed)		(Printed) 1-31-91 8:45Am Deloves Sparks	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				- 1 Blank enclosed - use form that reports < 5 μ
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ Lee Group

The Materials Characterization Specialists

North, IL
Addison, IL

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2066163	W-128-01	INSIDE, #6, LIVING ROOM	1643.5	25	50	YES
2066164	W-128-02	INSIDE, #6, BACK CORNER BEDROOM	1709.75	25	50	YES
2066165	W-128-03	INSIDE, #6, MASTER BEDROOM	1830.5	25	50	YES
2066166	W-128-04	INSIDE, #6, BATHROOM	1722	25	50	YES
2066167	W-128-05	OUTSIDE, #6, FRONT	1824.5	25	50	YES
2066168	W-128-06	OUTSIDE, #6, FRONT	1708.8	25	50	YES
2066169	W-128-07	INSIDE, #4, LIVING ROOM	1618.5	25	50	YES
2066170	W-128-08	INSIDE, #4, REAR CENTRAL BEDROOM	1709.8	25	50	YES
2066171	W-128-09	INSIDE, #4, MASTER BEDROOM	1604.4	25	50	YES
2066172	W-128-10	INSIDE, #4, BATHROOM	1772.4	25	50	YES
2066173	W-128-11	OUTSIDE, #4, FRONT	1674.75	25	50	YES
2066174	W-128-12	OUTSIDE, #4, FRONT	1575.75	25	50	YES
2066175	BLANK	BLANK	0	25	50	YES
2066176	A-129-01	INSIDE, #403, LIVING ROOM	1679.664	25	50	YES
2066177	A-129-02	INSIDE, #403, MASTER BEDROOM	1550.64	25	50	YES
2066178	A-129-03	INSIDE, #403, BATHROOM	1553.11	25	50	YES
2066179	A-129-04	INSIDE, #403, FRONT BEDROOM	1582.56	25	50	YES
2066180	A-129-05	OUTSIDE, #403, FRONT	1640.88	25	50	YES
2066181	A-129-06	OUTSIDE, #403, FRONT	1744.08	25	50	YES
2066182	A-129-07	INSIDE, #410, LIVING ROOM	1749.02	25	50	YES
2066183	A-129-08	INSIDE, #410, MASTER BEDROOM	1878.78	25	50	YES

AED
SAMPLE PREPARER

TEG, JPM, TWS, TL, DRM
AED, DHG, RBG, KEI
TEM OPERATOR-ANALYST

Tom Dagenhart 2-2-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

North end
Addison, IL

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 2, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101068
CLIENT JOB NUMBER: 61.5510.003.1
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA LEVEL II (YAMATE, ET AL., 1984)

ANALYTICAL INFORMATION

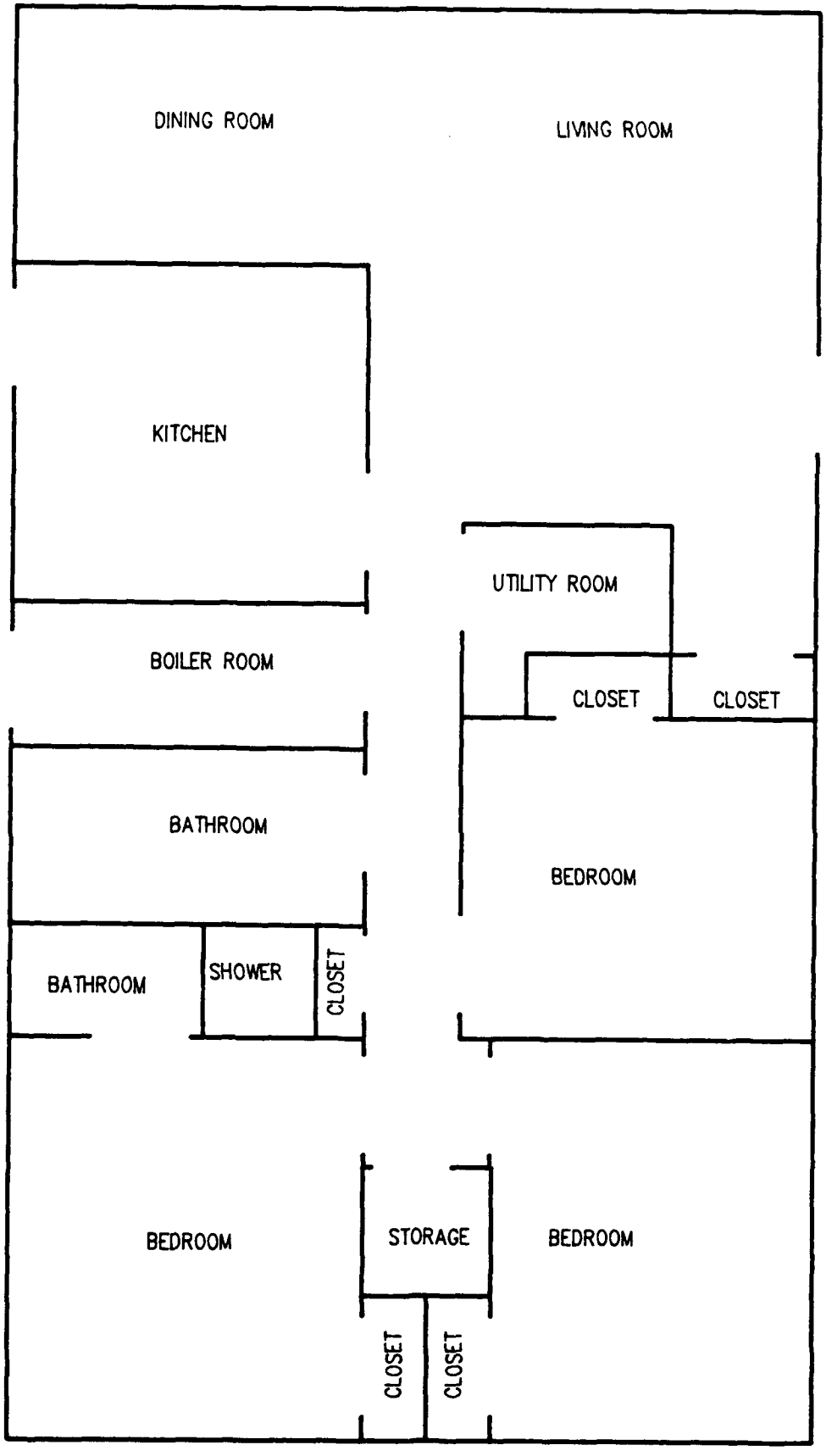
AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS
TEM: PHILIPS CM12

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 3 : 1, SORTED BY LENGTH < 5.0 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2066163	0.0044	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066164	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066165	0.0045	7	1.0	0.0463	0	0	0	< 21.58	< 0.005	NONE DETECTED
2066166	0.0042	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066167	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066168	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066169	0.0045	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066170	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066171	0.0045	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066172	0.0041	8	1.0	0.0530	1	0	1	18.88	0.004	CHRYSOTILE
2066173	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066174	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066175	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066176	0.0043	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066177	0.0047	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066178	0.0047	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066179	0.0046	8	1.0	0.0530	0	0	0	< 18.88	< 0.005	NONE DETECTED
2066180	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066181	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066182	0.0042	8	1.0	0.0530	0	0	0	< 18.88	< 0.004	NONE DETECTED
2066183	0.0044	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED

Worth #6
#4
Addison #403
#410

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

NIKE NY54
HOLMDEL, NEW JERSEY



HOLMED FHU
FLOOR PLAN

DRAWING: D:\5510\003.05\PROTO1.DWG PROJECT #: 61.5510.007.05 DATE: 2/25/91

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510,3,2 Client: USATHAMA – NJ (HOMDEL)
Program Manager: B. MAESTRI Sample Location: UNIT # 206
Date: 1/31/91 Shift: DAY Samples Collected by: A. McKissick / P Rustano
Collection Method: AHERA Analyze For: Airborne Asbestos
Sample Media: 0.45μ MCE Lot No: NUCLEOPORE # 819 / 00416737 OL
OCCUPIED UNIT # 206
PETTY OFFICER MARZELLA

SAMPLE DATA

	9	9	10	11	12	13	14
Sample No.	68099	68100	68101	68102	68103	68104	68105
Pump No.	1207	1232	1668	1961	1729	1249	FIELD BLANK
Time On	~~0953~~ 1345	1015	1015	1015	1015	1015	
Time Off	~~1668~~ 1345	1345	1345	1345	1345	1345	
Total Time (min)	210	210	210	210	210	210	
Flow Rate (LPM)	9.9	9.7	9.8	10.1	9.9	10.0	
Volume (liters)	2079	2037	2058	2121	1922 ☑	1942 ☑	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

OUTSIDE TEMP = 30°F. Therefore, Volume Corrected for Temperature

SAMPLE LOCATION

	Sample #		Height	Location	Type	Phase	Abatement	Sampling
8	68099	LIVING ROOM SIDE WALL Bet. windows	5'		A			NA
9	68100	KITCHEN BY REFRIGERATOR						
10	68101	BEDROOM FRONT (STREET SIDE)						
11	68102	BATHROOM BY SINK						
12	68103	OUTSIDE IN CARPORT						
13	68104	OUTSIDE, IN CARPORT						

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1227	9.4	~~9.4~~ 9.4	10.0		1/31/91
1232	9.8	9.5			
1668	10.0	9.6			
1961	10.4	9.8			
1229	9.8	10.0			
1249	9.9	10.1	✓		✓

Name of Calibrator CALIBRATOR : Cell # 5972-11

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times lpm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - HOMDEL, NJ

Program Manager: B. NAFSTAD Sample Location: UNIT # 207

Date: 1/31/91 Shift: DAY Samples Collected by: A. MCKISSICK / P. CRESCENZ

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: Nuclepore # 819 / 004G270L

UNIT 207 - OCCUPIED

SGT ~~LAFALCE~~ LA FALCE

SAMPLE DATA

	1	2	3	4	5	6	7
Sample No.	68092	68093	68094	68095	68096	68097	68098
Pump No.	1224	1682	1672	1246	1663	1669	FIELD BLANK
Time On	0945	0945	0945	0945	0945	0945	
Time Off	1320	1320	1320	1320	1320	1320	
Total Time (min)	215	215	215	215	215	215	
Flow Rate (LPM)	9.8	9.8	9.7	9.7	10.0	9.8	
Volume (liters)	2107	2107	2086	2086	1988 [4]	1948 [4]	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

[4] TEMP 50°F, Weights, Volume corrected for Temperature

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
1	68092 LIVING ROOM, AT INTERFACE W/ DINING ROOM			A			NA
2	68093 KITCHEN, BY REFRIGERATOR						
3	68094 BEDROOM, BY OUTSIDE WALL						
4	68095 BATHROOM, BY SINK						
5	68096 OUTSIDE CARPORT						
6	68097 OUTSIDE, CARPORT						

Location: W = Work Area, O = Outside/Perimeter

Type: G = General Area, P = Personal, A = Ambient, B = Field Blank

Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air

Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel

Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1669	9.8	9.8	10.0		1/31/91
1663	10.0	10.0			
1246	9.9	9.5			
1672	9.9	9.5			
1682	9.9	9.7			
1224	9.9	9.6			
Name of Calibrator CALIBRATOR, Coll # 5972-H					

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - HOMDEL, NJ
Program Manager: B. MAESTRI Sample Location: UNOCCUPIED UNIT # 212
Date: 1/3/91 Shift: DAY Samples Collected by: A. McKissick / P. Pistone
Collection Method: AHERA Analyze For: Airborne Asbestos
Sample Media: 0.45 µ MCE Lot No: Nuclepore # 819/004 G270L

SAMPLE DATA

	15	16	17	18	19	20	21
Sample No.	68106	68107	68108	68109	68110	68111	68112
Pump No.	1224	1682	1672	1246	1663	1669	FIELD BLANK
Time On	1425	1425	1425	1425	1425	1425	
Time Off	1820	1820	1820	1820	1820	1820	
Total Time (min)	235	235	235	235	235	235	
Flow Rate (LPM)	9.6	9.7	9.4	9.5	9.9	9.8	
Volume (liters)	2256	2280	2209	2233	[1] 2113	[1] 2092	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

[1] OUTSIDE TEMP = 35°F, Therefore, volume correction is applied.

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
15	68106	LIVING ROOM, SIDE WALL BATH WINDOW	5'		A		NA
16	68107	KITCHEN, IN FRONT OF REFRIGER.					
17	68108	BEDROOM CENTER					
18	68109	BATHROOM, BY SINK					
19	68110	OUTSIDE, BACK DOOR SIDEWALK.					
20	68111	OUTSIDE, BACK DOOR SIDEWALK					

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1669	9.8	9.7	10.0		1/3/91
1663	10.0	9.7			
1246	9.5	9.5			
1672	9.5	9.3			
1682	9.7	9.6			
1224	9.6	9.5			
Name of Calibrator	GILIBRATOR 1		CELL #	5972-H	

Temp.: 70°F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USATHAMA – HOMDEL, NJ

SAMPLERS: (Signature) Alton M McKissick (Printed) Alton M McKissick

INDUSTRIAL HYGIENE SAMPLE: Y / (N)

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

OCCUPIED UNIT # 206

REMARKS (Patty office MARZELLA)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68099	1/3/91		I		LIVING ROOM	1	1	Vol = 2079 l
68100	|		|		KITCHEN	1	1	Vol = 2037 l
68101	|		|		BEDROOM	1	1	Vol = 2058 l
68102	|		|		BATHROOM	1	1	Vol = 2121 l
68103	|		|		OUTSIDE	1	1	Vol = 1922 l
68104	|		I		OUTSIDE	1	1	Vol = 1942 l
68105	I			I	FIELD BLANK	1	1	

COPY

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	2/1/91	Delores Sparks			
(Printed) Alton M McKissick	FED/EX AUG @ RARITAN CANADA	(Printed) 2-2-91 9:30 Am Delores Sparks	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks FIRST, ANALYZE 68099 – 68102 and 68105. IF ANY ON 68099 – 68102 is >0.005 f/cc, Analyze 68103 + 68104	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA – HOMDEL, NJ	Y / N

SAMPLERS: (Signature) Alton M McKissick (Printed) Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

HOMDEL, NJ UNOCCUPIED UNIT

REMARKS #212 (ABANDONED UNIT)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	
68106	1/31/91		I		LIVING ROOM	1	1	Vol = 2256 ℓ
68107					KITCHEN	1	1	Vol = 2280 ℓ
68108					BEDROOM	1	1	Vol = 2209 ℓ
68109					BATH ROOM	1	1	Vol = 2233 ℓ
68110					OUTSIDE	1	1	Vol = 2113 ℓ
68111					OUTSIDE	1	1	Vol = 2092 ℓ
68112				I	FIELD BLANK	1	1	

COPY

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	2/1/91	Melorea Sparks			
(Printed) Alton M McKissick	FED EX PKG @ Ramada-RARITAN	(Printed) 2-2-91 9:30am Delores Sparks	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		FIRST ANALYZE 68106 – 68109 and 68112, IN ANY ONE of 68106 – 68109 IS >0.005 f/cc, Analyze 68110 and 68111.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USARMY - HOMPEL, NJ

SAMPLERS: (Signature)	(Printed)
Alton M McKissick	ALTON M MCKISSICK

INDUSTRIAL HYGIENE SAMPLE: Y / N

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

HOMPEL, NJ # OCCUPIED UNIT 207

REMARKS (SGT LA FALCE)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68092	1/31/91		↓		LIVING ROOM	1	1	VOL = 2107 l
68093					KITCHEN	1	1	VOL = 2107 l
68094					BEDROOM	1	1	VOL = 2086 l
68095					BATHROOM	1	1	Vol = 2086 l
68096					OUTSIDE	1	1	Vol = 1988 l
68097					OUTSIDE	1	1	Vol = 1948 l
68098				I	FIELD BLANK	1	1	

COPY

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	2/1/91	Delores Sparks			
(Printed) ALTON M MCKISSICK	FED EX PICKUP AT RARITAN RAMADA	(Printed) Delores Sparks 2-2-91 9:30 AM	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks: ANALYZE 68092 - 68095 and 68098 FIRST. IF ANY ONE of 68092-68095 is > 0.005 f/cc, Analyze 68096 + 68097	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ Lee Group

The Materials Characterization Specialists

Holmdel, NJ

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: FEBRUARY 2, 1991
RJ LEE GRP. JOB NUMBER: ATW-102004
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
66357	68092	LIVING ROOM	2107	25	50	YES
66358	68093	KITCHEN	2107	25	50	YES
66359	68094	BED ROOM	2086	25	50	YES
66360	68095	BATHROOM	2086	25	50	YES
66361	68096	OUTSIDE	1988	25	50	YES
66362	68097	OUTSIDE	1948	25	50	YES
66363	68098	FIELD BLANK	0	25	50	YES
66364	68099	LIVING ROOM	2079	25	50	YES
66365	68100	KITCHEN	2037	25	50	YES
66366	68101	BED ROOM	2058	25	50	YES
66367	68102	BATHROOM	2121	25	50	YES
66368	68103	OUTSIDE	1922	25	50	YES
66369	68104	OUTSIDE	1942	25	50	YES
66370	68105	FIELD BLANK	0	25	50	YES
66371	68106	LIVING ROOM	2256	25	50	YES
66372	68107	KITCHEN	2280	25	50	YES
66373	68108	BED ROOM	2209	25	50	YES
66374	68109	BATHROOM	2233	25	50	YES
66375	68110	OUTSIDE	2113	25	50	YES
66376	68111	OUTSIDE	2092	25	50	YES
66377	68112	FIELD BLANK	0	25	50	YES

GK
SAMPLE PREPARER

GK KO DLR AEDSPSTy
TEM OPERATOR-ANALYST

Thomas Dagenhart 2-4-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3
PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT PAGE 1 OF 3

RJ LeeGroup

The Materials Characterization Specialists

Holmdel, NJ

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: FEBRUARY 2, 1991
RJ LEE GRP. JOB NUMBER: ATW-102004
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EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

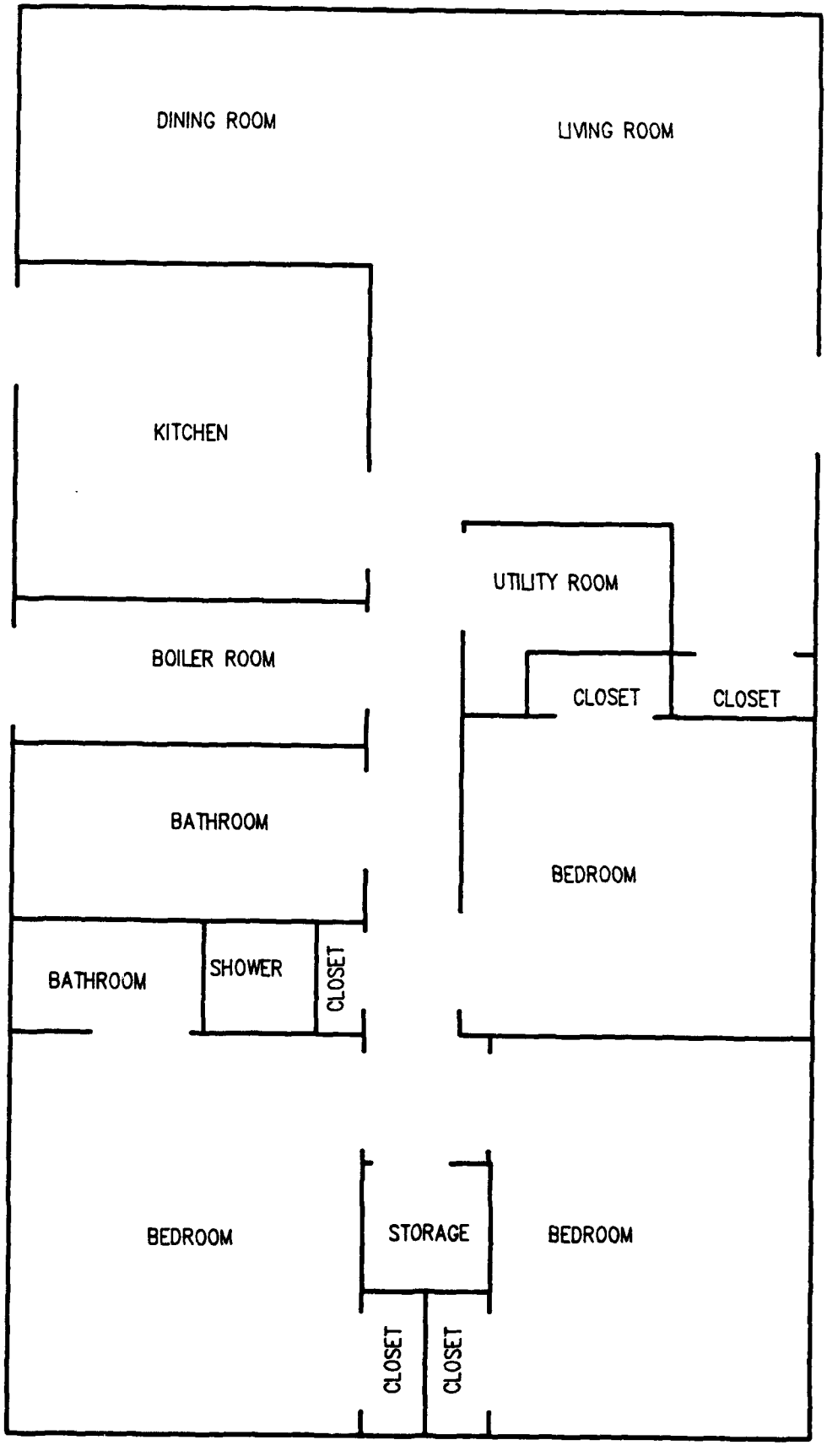
AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS
TEM: PHILIPS CM12

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
66357	0.0046	6	1.0	0.0393	0	0	0	< 25.44	< 0.005	NONE DETECTED
66358	0.0046	6	1.0	0.0393	0	0	0	< 25.44	< 0.005	NONE DETECTED
66359	0.0040	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
66360	0.0040	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
66361	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66362	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66363	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
66364	0.0040	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
66365	0.0041	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
66366	0.0041	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
66367	0.0046	6	1.0	0.0393	0	0	0	< 25.44	< 0.005	NONE DETECTED
66368	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66369	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66370	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
66371	0.0043	6	1.0	0.0393	0	0	0	< 25.44	< 0.004	NONE DETECTED
66372	0.0043	6	1.0	0.0393	0	0	0	< 25.44	< 0.004	NONE DETECTED
66373	0.0044	6	1.0	0.0393	0	0	0	< 25.44	< 0.004	NONE DETECTED
66374	0.0044	6	1.0	0.0393	0	0	0	< 25.44	< 0.004	NONE DETECTED
66375	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66376	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66377	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

#207
#206
#212

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

NIKE NY 60
OLD BRIDGE, NEW JERSEY



OLD BRIDGE FHU
FLOOR PLAN

DRAWING D:\5510\003.05\PROTO1.DWG PROJECT # 61.5510.007.05 DATE: 2/25/91

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USA RHAMA - OLD BRIDGE

Program Manager: B. MAESTRI Sample Location: OLD BRIDGE NJ

Date: 1/29/91 Shift: DAY Samples Collected by: A. MIKISSICK / P. KESTONE

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: NOLLSCOPIC 819/004 G27 OL
UNOCCUPIED UNIT # 20L

SAMPLE DATA

Sample No.	68071	68072	68073	68074	68075	68076
Pump No.	1227	1224	1682	1961	1663	1668
Time On	1315	1315	1315	1315	1315	1315
Time Off	1655	1655	1655	1655	1655 [1]	1655 [1]
Total Time (min)	220	220	220	220	220	220
Flow Rate (LPM)	10.0	9.7	9.7	10.0	9.9	9.9
Volume (liters)	2200	2134	2134	2200	2178	2178
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68077 FIELD BLANK

[1] OUTSIDE TEMP = 50°F, VOL CORRECTION IS < 5% ∴ NO CORRECTION MADE

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68071	LIVING ROOM SIDEWALL, BETWEEN WINDOWS	5		A			NA
68072	KITCHEN, IN FRONT OF WASHER HOOKUP	5		A			NA
68073	BEDROOM, CENTER	5		A			NA
68074	BATH ROOM IN FRONT OF SINK	5		A			NA
68075	OUTSIDE, KITCHEN DOOR SIDE WALL	5		A			NA
68076	OUTSIDE KITCHEN DOOR SIDE WALL	5		A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1668	9.9	9.9	10.0		9/24/91
1239	9.9	9.5	10.0		"
1682	9.8	9.5	10.0		"
1663	9.9	9.8	10.0		"
1227	10.1	9.8	10.0		"
1961	10.1	9.9	10.0		✓

Name of Calibrator GILIBRATOR ; Roll # 5972-H

Temp.: 70°F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust X General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times \text{lpm} \times \text{minutes} \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - OLD BRIDGE, NJ

Program Manager: B. MAESTRI Sample Location: UNIT # 209

Date: 1/30/91 Shift: DAY Samples Collected by: A. McKANK / P. RUSTONE

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45 µ MCE Lot No: Nucleopore # 819/004 G27 OL

OCCUPIED SFC MUNKACSY

SAMPLE DATA

Sample No.	68078	68079	68080	68081	68082	68083
Pump No.	1668	1961	1227	1682	[1] 1229	[1] 1663
Time On	0915	0915	0915	0915	0915	0915
Time Off	1310	1310	1310	1310	1310	1310
Total Time (min)	235	235	235	235	235	235
Flow Rate (LPM)	9.7	10.2	9.8	9.7	9.5	9.8
Volume (liters)	2280	2397	2303	2280	2233	2303
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68084 FIELD BLANK

[1] TEMP OUTSIDE = 53°F ∴ NO FLOW RATE CORRECTION NECESSARY

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68078	LIVING ROOM; BY FRONT DOOR	5'		A			NA
68079	KITCHEN; IN FRONT OF WASHER	"		"			"
68080	BEDROOM; AT BATHROOM DOORWAY	"		"			"
68081	BATHROOM; IN FRONT OF SINK	"		"			"
68082	OUTSIDE; MAILBOX	"		"			"
68083	OUTSIDE; CARPORT	"		"			"

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1668	9.9	9.4	10.0		1/30/91
1961	10.3	10.0	"		"
1227	9.9	9.6	"		"
1682	9.8	9.5	"		"
1229	9.5	9.5	"		"
1663	9.9	9.7	"		"
Name of Calibrator	GILIBRATOR; CELL # 5972-H				

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: ___ Local Exhaust ✓ General Area ___ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

Batch No. 1
Page 1 of 1

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - OLD BRIDGE, NJ
Program Manager: B. MARESTRI Sample Location: UNIT # 212
Date: 1/30/91 Shift: DAY Samples Collected by: A. McKissick / K. Postowe
Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS
Sample Media: 0.45μ MCE Lot No: Nucleopore # 819/004G 270L

OCCUPIED SFC HOUSE

SAMPLE DATA

Sample No.	68085	68086	68087	68088	68089	68090
Pump No.	1669	1672	1246	1232	1224	1249
Time On	1010	1010	1010	1010	1010	1010
Time Off	1340	1340	1340	1340	1340	1340
Total Time (min)	210	210	210	210	210	210
Flow Rate (LPM)	9.8	10.0	9.8	9.7	9.7	9.8
Volume (liters)	2058	2100	2058	2037	2037	2058
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68091 FIELD BLANK

[1] TEMP OUTSIDE = 53°F, THEREFORE, NO VOLUME CORRECTION NECESSARY

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68085	LIVING ROOM, SIDE WALL BET WINDOWS	5'		A			NA
68086	KITCHEN, IN FRONT OF STOVE	"		"			"
68087	BEDROOM, IN FRONT OF BATH ROOM DOOR	"		"			"
68088	BATHROOM, IN FRONT OF SINK	"		"			"
68089	OUTSIDE, CARPORT	"		"			"
68090	OUTSIDE, CARPORT	"		"			"

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
			10.0		
1669	10.0	9.5	10.0		1/30/91
1672	10.2	9.7	10.0		"
1246	10.0	9.5	10.0		"
1232	10.0	9.4	10.0		"
1224	9.8	9.6	10.0		"
1249	10.0	9.5	10.0		"
Name of Calibrator	GILIBRATOR ; Roll # 5972-H				

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____ _____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USATHAMA - OLD BRIDGE, NS

SAMPLERS: (Signature)	(Printed)
Alton M McKissick	Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

INDUSTRIAL HYGIENE SAMPLE: Y / N

OLD BRIDGE, NS
UNIT # 206

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS (UNOCCUPIED)
68071	1/29/91		T		LIVING ROOM	1	1	Vol = 2200 l
68072	|		|		KITCHEN	1	1	Vol = 2134 l
68073	|		|		BED ROOM	1	1	Vol = 2134 l
68074	|		|		BATH ROOM	1	1	Vol = 2200 l
68075	|		|		OUTSIDE	1	1	Vol = 2178 l
68076	|		|		OUTSIDE	1	1	Vol = 2178 l
68077	~			I	FIELD BLANK	1	1	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/30/91				
(Printed) ALTON M McKISSICK	FED/EX PICKUP AT RARITAN RAMADA	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by: (Signature)**	**Date / Time**	**Remarks** ANALYZE 68071 - 68074 and 68077. IF ANY ONE OF 68071 - 68074 IS > 0.005 f/cc, analyse 68075 and 68076.	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510.3.2	USATHAMA; OLD BRIDGE, NJ	

SAMPLERS: (Signature) Alton M McKissick (Printed) Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

OLD BRIDGE, NJ

REMARKS: OCCUPIED UNIT # 212 (SFC HOUDE)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68085	1/30/91		T		LIVING ROOM	1	1	VOL = 2058 l
68086					KITCHEN	1	1	VOL = 2100 l
68087					BEDROOM	1	1	VOL = 2058 l
68088					BATHROOM	1	1	VOL = 2037 l
68089					OUTSIDE	1	1	VOL = 2037 l
68090					OUTSIDE	1	1	VOL = 2058 l
68091				I	FIELD BLANK	1	1	OPENED FOR 30 SEC

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/31/91	Delores Sparks			
(Printed) Alton M McKissick	FED/EX PICK UP AT ADRIAN ROMANO	(Printed) Delores Sparks	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		Analyze 68085 - 68088 and 68091. IF ANY ONE OF 68085 - 68088 IS >0.005 f/cc, Analyze 68090 and 68091

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA - OLD BRIDGE, NJ.	Y / N

SAMPLERS: *(Signature)* (Printed)

PARAMETERS: NO. OF CONTAINERS; ASBA (ITEM)

OLD BRIDGE, NJ

REMARKS: OCCUPIED UNIT #209 CSFC NIUNKACSY

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (ITEM)	REMARKS
68078	1/30/91		T		LIVING ROOM	1	1	VOL = 2280 l
68079					KITCHEN	1	1	VOL = 2397 l
68080					BEDROOM	1	1	VOL = 2303 l
68081					BATHROOM	1	1	VOL = 2280 l
68082					OUTSIDE	1	1	VOL = 2233 l
68083					OUTSIDE	1	1	VOL = 2303 l
68084				I	BLANK (FIELD)	1	1	OPEN FOR SO SOC

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/31/91	Delores Sparks			
(Printed) Alton M McKissick	FRIDAY PICK UP AT RAMADA	(Printed) Delores Sparks	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68078 - 68081 and 68084. IF ONE OF 68078 - 68081 IS > 0.005 f/cc, ANALYZE 68082 + 68083

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Rocky Point, NY
Cla Bridge NJ

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101069
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
66196	68057	LIVING ROOM	2938	25	50	YES
66197	68058	KITCHEN	2999	25	50	YES
66198	68059	BED ROOM	3029	25	50	YES
66199	68060	BATHROOM	2968	25	50	YES
66200	68061	OUTSIDE	2907	25	50	YES
66201	68062	OUTSIDE	2876	25	50	YES
66202	68063	FIELD BLANK	0	25	50	YES
66203	68064	LIVING ROOM	1969	25	50	YES
66204	68065	KITCHEN	1930	25	50	YES
66205	68066	BED ROOM	1911	25	50	YES
66206	68067	BATHROOM	1891	25	50	YES
66207	68068	OUTSIDE	1891	25	50	YES
66208	68069	OUTSIDE	1891	25	50	YES
66209	68070	FIELD BLANK	0	25	50	YES
66210	68071	LIVING ROOM	2200	25	50	YES
66211	68072	KITCHEN	2134	25	50	YES
66212	68073	BED ROOM	2134	25	50	YES
66213	68074	BATHROOM	2200	25	50	YES
66214	68075	OUTSIDE	2178	25	50	YES
66215	68076	OUTSIDE	2178	25	50	YES
66216	68077	FIELD BLANK	0	25	50	YES

EI
SAMPLE PREPARER

EJ, LJK, LG
TEM OPERATOR-ANALYST

Thomas Dagenhart 2-4-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Rocky Point NY
Old Bridge, NJ

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101069
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER
TEM: PHILIPS CM12
EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILU-TION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
66196	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66197	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66198	0.0019	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66199	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66200	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66201	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66202	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
66203	0.0030	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66204	0.0030	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66205	0.0031	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66206	0.0031	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66207	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66208	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66209	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
66210	0.0027	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66211	0.0028	10	1.0	0.0655	0	1	1	15.26	0.003	CHRYSOTILE
66212	0.0028	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66213	0.0027	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66214	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66215	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66216	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

Rocky # 11
5
Old Bridge # 205

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RJ LeeGroup

The Materials Characterization Specialists

Old Bridge, NJ

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: FEBRUARY 1, 1991
RJ LEE GRP. JOB NUMBER: ATW-102001
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
66226	68078	INSIDE, LIVING ROOM	2280	25	50	YES
66227	68079	INSIDE, KITCHEN	2397	25	50	YES
66228	68080	INSIDE, BEDROOM	2303	25	50	YES
66229	68081	INSIDE, BATHROOM	2280	25	50	YES
66230	68082	OUTSIDE	2233	25	50	YES
66231	68083	OUTSIDE	2303	25	50	YES
66232	68084	FIELD BLANK	0	25	50	YES
66233	68085	INSIDE, LIVING ROOM	2058	25	50	YES
66234	68086	INSIDE, KITCHEN	2100	25	50	YES
66235	68087	INSIDE, BEDROOM	2058	25	50	YES
66236	68088	INSIDE, BATHROOM	2037	25	50	YES
66237	68089	OUTSIDE	2037	25	50	YES
66238	68090	OUTSIDE	2058	25	50	YES
66239	68091	FIELD BLANK	0	25	50	YES

Unit 250

Unit 212

KS
SAMPLE PREPARER

KS
TEM OPERATOR-ANALYST

Thomas Dagenhart 2-4-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

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METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
66226	0.0043	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
66227	0.0049	5	1.0	0.0331	0	0	0	< 30.21	< 0.005	NONE DETECTED
66228	0.0042	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
66229	0.0043	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
66230	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66231	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66232	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
66233	0.0047	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
66234	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
66235	0.0047	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
66236	0.0048	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
66237	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66238	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66239	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED

#209

#212

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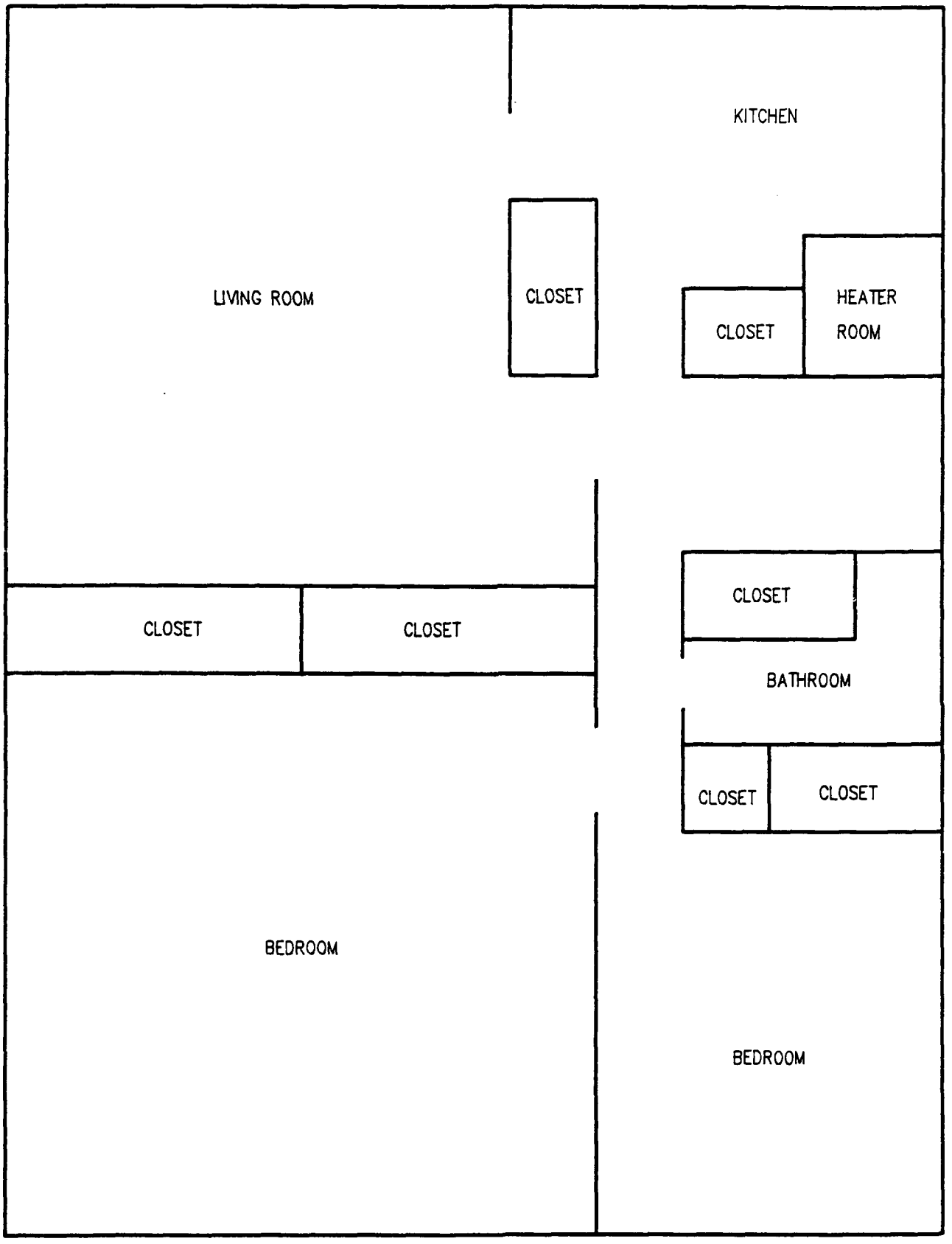
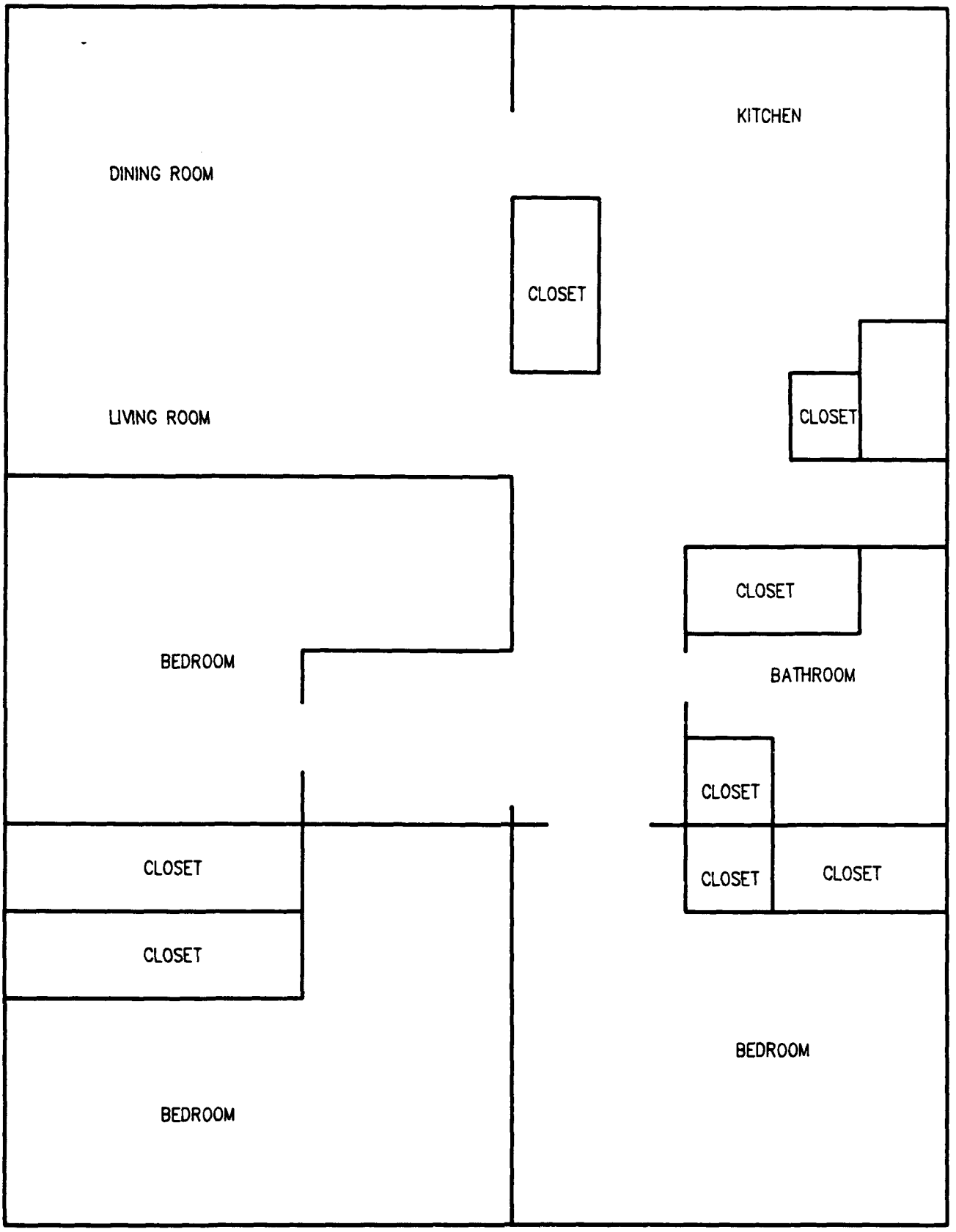
BERKELEY, CA MONROEVILLE, PA WESTERN NY

NIKE NY 25
ROCKY POINT, NEW YORK



ROCKY POINT FHU 05

2 BEDROOM FLOOR PLAN



ROCKY POINT FHU 11

3 BEDROOM FLOOR PLAN

Batch No. 1
Page 1 of 1

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - ROCKY POINT, NY

Program Manager: B. MAESTRI Sample Location: HOUSING UNIT #5

Date: 1/28/91 Shift: DAY Samples Collected by: A. McKISSICK / P. PESTONE

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: NUCLEPORE lot # 819/004G270L

OCCUPIED UNIT #5
SGT PERRY

SAMPLE DATA

Sample No.	68064	68065	68066	68067	68068	68069
Pump No.	1961	1682	1668	1232	1663	1246
Time On	1134	1134	1134	1134	1134	1134
Time Off	1447	1447	1447	1447	1447	1447
Total Time (min)	193	193	193	193	193	193
Flow Rate (LPM)	10.2	10.0	9.9	9.8	9.8	9.8
Volume (liters)	1969	1930	1911	1891	a 1891	a 1891
Employee Name/ID	–	–	–	–	–	–
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68070 FIELD BLANK

a/ OUTSIDE TEMP = 50°F. NO CORRECTION MADE SINCE THIS IS < 5%.

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68064	LIVING ROOM wall between windows	5'		A			NA
68065	KITCHEN IN FRONT of Washer	|		|			|
68066	BEDROOM (wall near bed)	|		|			|
68067	BATHROOM (IN FRONT of SINK)	|		|			|
68068	OUTSIDE	|		|			|
68069	OUTSIDE	↓		↓			↓

Location: W - Work Area, O - Outside/Perimeter
Type: G - General Area, P - Personal, A - Ambient, B - Field Blank
Phase: S - Pre-Start, E - Establish Containment, R - Removal, C - Clean, Up, F - Final Air
Abatement: FP - Fireproofing, CT - Ceiling Tiles, FT - Floor Tiles, BI - Boiler, PL - Pipe Lagging, TP - Transite Panel
Sampling: AG - Aggressive, NA - Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1461	10.6	9.7	10.0		1/25/91
1682	10.2	9.5	10.0		1
1668	10.2	9.6	10.0		1
1232	10.0	9.6	10.0		1
1663	10.0	9.5	10.0		1
1246	9.9	9.6	10.0		1
Name of Calibrator GILIBRATOR ; CELL # 5972-H					

Temp.: 70°F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USAIHAMA - ROCKY POINT, NY
Program Manager: B. MAESTRI Sample Location: HOUSING UNIT # 11
Date: 1/28/91 Shift: DAY Samples Collected by: A. McKISSICK / P. PESONE
Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS
Sample Media: 0.45 µ MCE Lot No: NUCLEPORE # 819/004 G 270L
OCCUPIED UNIT # 11
SGT. PIERCE

SAMPLE DATA

Sample No.	68057	68058	68059	68060	68061	68062
Pump No.	1229	1227	1224	1672	1669	1249
Time On	1034	1034	1034	1034	1034	1034
Time Off	1400	1400	1400	1400	1400	1400
Total Time (min)	306	306	306	306	306	306
Flow Rate (LPM)	9.6	9.8	9.9	9.7	9.5	9.4
Volume (liters)	2938	2999	3029	2968	2907	2876
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68063 BLANK (FIELD)

OUTSIDE TEMP = 50F, NO CORRECTION MADE SINCE ΔP < 5%

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68057	LIVING ROOM, BEHIND COUCH ~ TV	5'		A			NA
68058	KITCHEN, IN FRONT OF CLOTHS WASHER	"		"			"
68059	BED ROOM (@ SOUTH WALL)	"		"			"
68060	BATHROOM, IN FRONT OF SINK	"		"			"
68061	OUTSIDE, STOOP; LIVING RM DOOR	"		"			"
68062	OUTSIDE, " " " "	"		"			"

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1249	9.5	9.3	10.0		1/28/91
1229	9.8	9.4	10.0		"
1672	10.0	9.4	10.0		"
1227	9.9	9.7	10.0		"
1669	9.7	9.2	10.0		"
1224	10.1	9.7	10.0		✓
Name of Calibrator	CALIBRATOR	CAL #	5972-H		

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USATHAMA – ROCKY POINT, NY

SAMPLERS: (Signature) Alton M McKissick (Printed) ALTON M MCKISSICK

PARAMETERS: NO. OF CONTAINERS; AS3A (TAM)

INDUSTRIAL HYGIENE SAMPLE (Y / N)

ROCKY POINT, NY UNIT # 11

REMARKS: OCCUPIED - SGT PINKLE

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	AS3A (TAM)	REMARKS
68057	1/28/91				LIVING ROOM	1	1	VOL = 2938 l
68058					KITCHEN	1	1	Vol = 2999 l
68059					BED ROOM	1	1	Vol = 3029 l
68060					BATH ROOM	1	1	Vol = 2968 l
68061					OUTSIDE	1	1	Vol = 2907 l
68062					OUTSIDE	1	1	Vol = 2876 l
68063				I	FIELD BLANK	1	1	N/A

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/30/91				
(Printed) Alton M McKissick	FEDEX AIRBILL AT RARITAN RAMAPO	(Printed)	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68057 – 68060 and 68063. IF ANY ONE OF 68057-68060 is > 0.005 f/cc, ANALYZE 68061 and 68062.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

VERSAR INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USATHAMA – ROCKY POINT, NY

SAMPLERS: (Signature) Alton M McKissick (Printed) ALTON M McKISSICK

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE (Y / N)	REMARKS
										ROCKY POINT, NY UNIT # 5 OCCUPIED BY SGT. PERRY
68064	1/28/91		T		LIVING ROOM	1	1			VOL = 1969 l
68065					KITCHEN	1	1			VOL = 1930 l
68066					BED ROOM	1	1			VOL = 1911 l
68067					BATHROOM	1	1			VOL = 1891 l
68068					OUTSIDE	1	1			VOL = 1891 l
68069					OUTSIDE	1	1			VOL = 1891 l
68070				I	FIELD BLANK	1	1			N/A

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/30/91				
(Printed) ALTON M McKISSICK	FED/EX PICKUP AT RARITAN REMANDA	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks ANALYZE 68064 – 68067 and 68070, IF ANY ONE OF 68064-68067 IS >0.005 f/cc, analyze 68068 and 68069.	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Rocky Point, NY
Old Bridge NJ

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: ATW-101069
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
66196	68057	LIVING ROOM	2938	25	50	YES
66197	68058	KITCHEN	2999	25	50	YES
66198	68059	BED ROOM	3029	25	50	YES
66199	68060	BATHROOM	2968	25	50	YES
66200	68061	OUTSIDE	2907	25	50	YES
66201	68062	OUTSIDE	2876	25	50	YES
66202	68063	FIELD BLANK	0	25	50	YES
66203	68064	LIVING ROOM	1969	25	50	YES
66204	68065	KITCHEN	1930	25	50	YES
66205	68066	BED ROOM	1911	25	50	YES
66206	68067	BATHROOM	1891	25	50	YES
66207	68068	OUTSIDE	1891	25	50	YES
66208	68069	OUTSIDE	1891	25	50	YES
66209	68070	FIELD BLANK	0	25	50	YES
66210	68071	LIVING ROOM	2200	25	50	YES
66211	68072	KITCHEN	2134	25	50	YES
66212	68073	BED ROOM	2134	25	50	YES
66213	68074	BATHROOM	2200	25	50	YES
66214	68075	OUTSIDE	2178	25	50	YES
66215	68076	OUTSIDE	2178	25	50	YES
66216	68077	FIELD BLANK	0	25	50	YES

EI
SAMPLE PREPARER

EJ, LJK, LG
TEM OPERATOR-ANALYST

Thomas Dagenhart 2-4-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Rocky Point, NY
Old Bridge, NJ

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: FEBRUARY 4, 1991
SAMPLE RECEIPT DATE: JANUARY 31, 1991
RJ LEE GRP. JOB NUMBER: AT [illegible]-101069
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 Kv
ENERGY DISPERSIVE X-RAY ANALYZER
TEM: PHILIPS CM12
EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
66196	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66197	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66198	0.0019	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66199	0.0020	10	1.0	0.0655	0	0	0	< 15.26	< 0.002	NONE DETECTED
66200	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66201	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66[illegible]	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< [illegible]	NOT APPL.	NONE DETECTED
66203	0.0030	10	1.0	0.0655	0	0	0	< [illegible].26	< 0.003	NONE DETECTED
66204	0.0030	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66205	0.0031	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66206	0.0031	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66207	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66208	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66209	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
66210	0.0027	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66211	0.0028	10	1.0	0.0655	0	1	1	15.26	0.003	CHRYSOTILE
66212	0.0028	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66213	0.0027	10	1.0	0.0655	0	0	0	< 15.26	< 0.003	NONE DETECTED
66214	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66215	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
66216	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

Rocky Point, NY
Old Bridge, NJ

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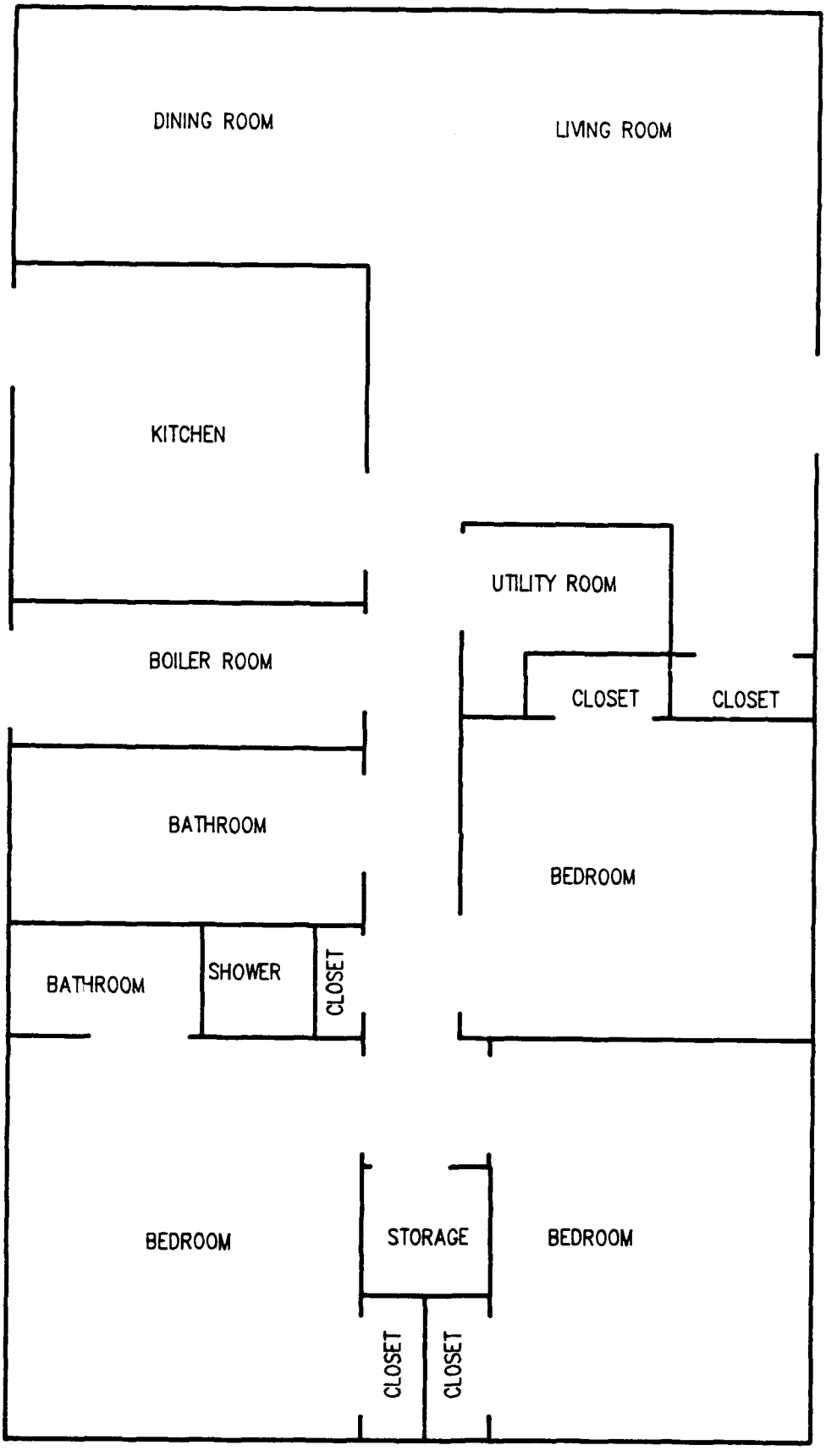
BERKELEY, CA MONROEVILLE, PA WESTERN NY

NIKE NY 99
SPRING VALLEY, NEW YORK



SPRING VALLEY FHU
FLOOR PLAN

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: CHAINMAN - SPRING VALLEY

Program Manager: B MAESTRI Sample Location: SPRING VALLEY NY UNIT # 203

Date: 1/24/91 Shift: DAY Samples Collected by: MCKISSICK / COSMANO

Collection Method: AIRTEST Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: MILLIPORE 319/0049 27 OL

OCCUPIED BY SGT HARVEY
UNIT # 203

SAMPLE DATA

Sample No.	68050	68051	68052	68053	68054	68055
Pump No.	1672	1229	1224	1669	1227	1246
Time On	0915	0915	0915	0915	0915	0915
Time Off	1250	1250	1250	1250	1250	1250
Total Time (min)	215	215	215	215	215	215
Flow Rate (LPM)	9.8	9.6	9.9	9.7	10.3	10.2
Volume (liters)	2107	2064	2129	2086	2215	2193
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68056 FIELD BLANK

CALIBRATED @ OUTSIDE TEMPERATURE, THEREFORE, NO CORRECTION NECESSARY

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68050	LIVING ROOM; IN FRONT OF LARGE WINDOW	5'		A			NA
68051	KITCHEN; IN FRONT OF COUNTER	↓	↓	↓	↓	↓	↓
68052	MASTER BEDROOM; BESIDE BED	↓	↓	↓	↓	↓	↓
68053	BATHROOM; BESIDE SINK	↓	↓	↓	↓	↓	↓
68054	OUTSIDE; STOOP; BY FURNACE ROOM DOOR	↓	↓	↓	↓	↓	↓
68055	OUTSIDE; STOOP; BY FURNACE ROOM DOOR	↓	↓	↓	↓	↓	↓

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1239	9.8	9.4	10.C		1/26/91
1224	10.C	9.8	"		"
1672	10.C	9.6	"		"
1669	10.C	9.4	"		"
☑ 1246	10.4	10.0	"		"
☑ 1227	10.4	10.1	"		"
Name of Calibrator GILIAN GILIBERTO; CELL # 5972-H					

Temp.: 70° F **Pressure:** **RH:**

1246 and 1227 CALIBRATED AT 20°C; TEMPERATURE OF THE OUTDOORS (NO VOLUME CORRECTION NECESSARY)

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times \text{lpm} \times \text{minutes} \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.7 Client: USA/HHA - SPRING VALLEY, NV

Program Manager: B. MAESTRI Sample Location: SPRING VALLEY UNIT # ~~208~~ 207

Date: 1/25/91 Shift: DAY Samples Collected by: A. McKissick / P. Mastone

Collection Method: AHERA Analyze For: Airborne Asbestos

Sample Media: 0.45μ MCE Lot No: Nuclepore 819/004 G27 OL

UNOCCUPIED UNIT # 207

SAMPLE DATA

Sample No.	68043 *	68044	68045 *	68046	68047	68048	68049 BLANK
Pump No.	1232	1224	1682	1229	1669	1672	
Time On	1153	1153	1153	1153	1153	1153	
Time Off	1602	1602	1602	1602	1602	1602	
Total Time (min)	249	249	249	249	249	249	
Flow Rate (LPM)	9.8	10.0	9.3	9.5	10.0	9.9	
Volume (liters)	See Page 2	2490	See Page 2	2366	~~2490~~ 2478	~~2256~~ 2256	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

* corrected for temp change

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68043	LIVING ROOM; SIDE WALL BETW WINDOWS	5'		A			N/A
68044	KITCHEN, IN FRONT OF WASH HOOKUP						
68045	MASTER BED ROOM; CENTER						
68046	BATH ROOM						
68047	OUTSIDE: KITCHEN STOOP						
68048	OUTSIDE: KITCHEN STOOP	↓		↓			↓

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1232	9.8	9.8	10.0		1/25/91
1224	10.1	9.4	10.0		"
1682	9.3	9.3	10.0		"
1229	9.5	9.5	10.0		"
1669	9.7	10.2	10.0		"
1672	9.5	10.3	10.0		"

Name of Calibrator GILIAN GILBRATH BELL H 5972-H

Temp.: 70° Pressure: Ambient RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: _____ Client: LIBATHAWA - SPRING VALLEY NY

Program Manager: _____ Sample Location: _____

Date: 1/26/91 Shift: _____ Samples Collected by: _____

Collection Method: _____ Analyze For: _____

Sample Media: _____ Lot No: _____

UNOCCUPIED UNIT # 207

SAMPLE DATA

Sample No.	68142	68141				
Pump No.	1682	1232				
Time On	0950	0850				
Time Off	1240	1240				
Total Time (min)	230	230				
Flow Rate (LPM)	10.0	9.7				
Volume (liters)	2300	2231				
Employee Name/ID	—	—				
Results F/CC						
Fibers/Fields						
Fibers/mm^2						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

a) SAMPLES 68145 and 68143 WERE REPORTED. FILTER RUPTURED DURING SAMPLING

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68142	BED ROOM - Same pump location	5'		A			NA
68141	LIVING ROOM AS 1/25/91	5'		A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	70°F Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1682	9,9		10.0		11/26/91
1232	9,8		10.0		11/26/91

Name of Calibrator GILIAN GILIBRANTOSK CELL # 597-2-44

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA

Program Manager: B. MAESTRI Sample Location: SPRING VALLEY UNIT 208

Date: 1/25/91 Shift: DAY Samples Collected by: A. McKissick / P. Pustone

Collection Method: AHERA Analyze For: AIRBORNE Asbestos (TEM)

Sample Media: 0.45μ MCE Lot No: Nuclepore 819/004 G2704

UNOCCUPIED UNIT # 208

SAMPLE DATA

Sample No.	68036	68037	68038	68039	68040	68041
Pump No.	1663	1227	1668	1249	1961	1246
Time On	1103	1103	1103	1103	1103	1103
Time Off	1543	1543	1543	1543	1543	1543
Total Time (min)	280	280	280	280	280	280
Flow Rate (LPM)	10.1	9.8	9.8	9.8	10.4	10.2
Volume (liters)	2828	2744	2744	2744	[1] 2665	[1] 2613
Employee Name/ID	—	—	—	—		
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68042 FIELD BLANK

[1] Corrected for temp change

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68036	LIVING ROOM; SIDE WALL Between Windows	5'		A			NA
68037	Kitchen; By ~~DISHWASHER~~ WASHER Connection	|		A			NA
68038	MASTER BED ROOM, CENTER	|		A			NA
68039	BATHROOM	|		A			NA
68040	OUTSIDE (KITCHEN STOOP)	|		A			NA
68041	OUTSIDE (KITCHEN STOOP)	↓		A			NA

Location: W = Work Area, O = Outside/Perimeter

Type: G = General Area, P = Personal, A = Ambient, B = Field Blank

Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air

Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel

Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1663	10.3	9.8	10.0		1/25/91
1227	10.0	9.6	10.0		"
1668	10.1	9.5	10.0		"
1249	10.0	9.5	10.0		"
1901	10.2	10.5	10.0		"
1246	10.0	10.3	10.0		"
Name of Calibrator	GILIBRATOR - Cell 5972-H				

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510.3.2	USATHAMA – SPRING VALLEY, NY	

SAMPLERS: (Signature)	(Printed)
Alton M McKissick	Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM); 1

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	1	REMARKS
									UNOCCUPIED UNIT # 208
68036	1/25/91		X		LIVING ROOM	1	1		Vol = 2828.ℓ
68037					Kitchen	1	1		Vol = 2744ℓ
68038					MASTER BED ROOM	1	1		Vol = 2744ℓ
68039					BATH ROOM	1	1		Vol = 2744ℓ
68040					OUTSIDE	1	1		Vol = 2665ℓ
68041					OUTSIDE	1	1		Vol = 2613ℓ
68042				X	BLANK	1	1		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/25/91	Connie L. Puckett			
(Printed)		(Printed)	(Printed)		(Printed)
Alton M McKissick	FED EX PICK UP @ Brookhaven pays	Connie L. Puckett			

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				ANALYSE 68036 – 68039 FIRST. IF ANY ONE OF THE FOUR IS > 0.005f/cc Analyse 68040 – 68042
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

VERSAR INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA - SPRING VALLEY UNIT # 207	Y / N

SAMPLERS: *(Signature)* Alton M McKissick (Printed) ALTON M McKISSICK

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: BSBA (TBM)	REMARKS
68142	1/26/91		I		LIVING ROOM	1	1	Vol = 2300 l — HOUSING UNIT # 207 (UNOCCUPIED)
68044	1/25/91		I		KITCHEN	1	1	Vol = 2490 l
68141	1/26/91		I		MASTER BED ROOM	1	1	Vol = ~~2300~~ 2231 l Avg
68046	1/25/91		I		BATH ROOM	1	1	Vol = 2366 l
68047	1		I		OUTSIDE	1	1	Vol = 2278 l
68048	1		I		OUTSIDE	1	1	Vol = 2256 l
68049	1/25/91			I	BLANK	1	1	

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/28/91	Connie L. Puckett			
(Printed) Alton M McKissick	Fed Ex pick up @ Brookhaven Dam	(Printed) Connie L Puckett	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		Analyze 68142, 68044, 68141, and 68046 FIRST. IN ANY ONE IS ~~2300~~ 70,000 f/cc, Analyze 68047 - 68049.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA – SPRING VALLEY UNIT # 203	(Y) N

SAMPLERS: *(Signature)* Alton M McKissick

(Printed) Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68050	1/26/91		T		Living Room	1	1	Housing Unit # 203 (Occupied) Vol = 2107 ℓ
68051					Kitchen	1	1	Vol = 2064 ℓ
68052					Master Bed Room	1	1	Vol = 2129 ℓ
68053					Bath Room	1	1	Vol = 2064 ℓ
68054					Outside, Furnace Room Side	1	1	Vol = 2215 ℓ
68055					" " "	1	1	Vol = 2143 ℓ
68056				X	Blank	1	1	

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/28/91	Connie L. Puckett			
(Printed) Alton M McKissick	DAYS - Brathaul Fed Ex Pick up	(Printed) Connie L. Puckett	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68050 - 68053 first; If any ON is > 0.005 f/cc, Analyze 68054 - 68056.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Spring Valley, NY

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM MILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 29, 1991
RJ LEE GRP. JOB NUMBER: ATW-101063
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL	
2066055	68036	LIVING ROOM	2828	25	50	YES	
2066056	68037	KITCHEN	2744	25	50	YES	
2066057	68038	MASTER BED ROOM	2744	25	50	YES	
2066058	68039	BATHROOM	2744	25	50	YES	
2066059	68040	OUTSIDE	2665	25	50	YES	
2066060	68041	OUTSIDE	2613	25	50	YES	
2066061	68042	FIELD BLANK	0	25	50	YES	
2066062	68~~42~~ 043	LIVING ROOM	2300	25	50	YES	type
2066063	68044	KITCHEN	2490	25	50	YES	
2066064	68~~44~~ 045	MASTER BED ROOM	2231	25	50	YES	type
2066065	68046	BATHROOM	2366	25	50	YES	
2066066	68047	OUTSIDE	2273	25	50	YES	
2066067	68048	OUTSIDE	2256	25	50	YES	
2066068	68049	FIELD BLANK	0	25	50	YES	
2066069	68050	LIVING ROOM	2107	25	50	YES	
2066070	68051	KITCHEN	2064	25	50	YES	
2066071	68052	MASTER BED ROOM	2129	25	50	YES	
2066072	68053	BATHROOM	2064	25	50	YES	
2066073	68054	OUTSIDE, FURNACE ROOM STOOP	2215	25	50	YES	
2066074	68055	OUTSIDE, FURNACE ROOM STOOP	2193	25	50	YES	
2066075	68056	FIELD BLANK	0	25	50	YES	

CT/TMW
SAMPLE PREPARER

TMW/TMW/CT
TEM OPERATOR-ANALYST

Tom Dagenhart 1-30-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3
PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

P.J Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

/

RJ LeeGroup

The Materials Characterization Specialists

Spring Valley, NY

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 29, 1991
RJ LEE GRP. JOB NUMBER: ATW-101063
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER
TEM: PHILIPS CM12
EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2066055	0.0041	5	1.0	0.0331	0	0	0	< 30.21	< 0.004	NONE DETECTED
2066056	0.0042	5	1.0	0.0331	1	0	1	30.21	0.004	CHRYSOTILE
2066057	0.0042	5	1.0	0.0331	0	1	1	30.21	0.004	CHRYSOTILE
2066058	0.0042	5	1.0	0.0331	2	0	2	60.42	0.008	CHRYSOTILE
2066059	0.0036	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066060	0.0037	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066061	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066062	0.0042	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066063	0.0047	5	1.0	0.0331	0	0	0	< 30.21	< 0.005	NONE DETECTED
2066064	0.0043	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066065	0.0049	5	1.0	0.0331	0	0	0	< 30.21	< 0.005	NONE DETECTED
2066066	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066067	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066068	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066069	0.0046	6	1.0	0.0397	1	0	1	25.18	0.005	CHRYSOTILE
2066070	0.0047	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066071	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066072	0.0047	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066073	0.0044	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066074	0.0044	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066075	NOT APPLICABLE	10	1.0	0.0662	1	0	1	15.11	NOT APPL.	CHRYSOTILE

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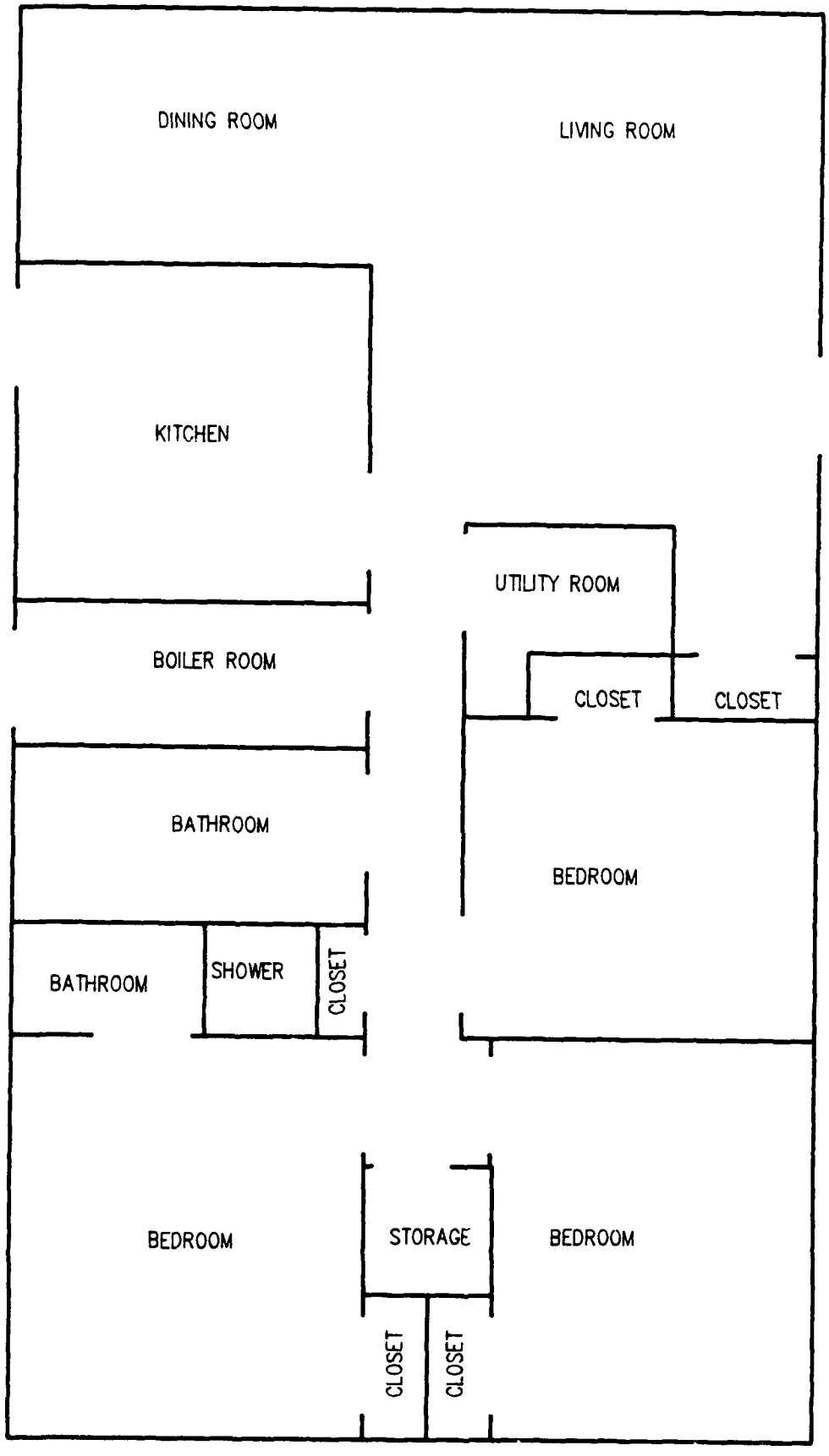
BERKELEY CA MONROEVILLE, PA WESTERN NY

NIKE NY 01
TAPPAN, NEW YORK



TAPPEN FHU
FLOOR PLAN

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA

Program Manager: B. MAGSIRI Sample Location: UNIT 402 - ~~MANCHAPPAN~~

Date: 1/24/90 Shift: _____ Samples Collected by: A. McCrossick / P. Costone

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45 MCE Lot No: NUCLEOPORE 819/004 G2702

UNOCCUPIED UNIT II 402

SAMPLE DATA

Sample No.	68015	68016	68017	68018	68019	68020	68021
Pump No.	1663	1961	1668	1249	1682	1246	BLANK (FIELD)
Time On	1109	1109	1109	1109	1109	1109	
Time Off	1434	1434 ~~1438~~	1435 ~~1434~~	1436	1438	1438	
Total Time (min)	205	205	206	207	208	208	
Flow Rate (LPM)	9.8	9.9	9.8	9.5	9.6	9.7	
Volume (liters)	2009	2030	2019	1967	1846 [a]	1866 [a]	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

[a] Corrected for Temp differential

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68015	LIVING ROOM (BY WINDOW SIDE WALL)	5'		A			NA
68016	KITCHEN (UNDER CABINETS)	5'		A			NA
68017	MASTER BED ROOM (BACK WALL)	5'		A			NA
68018	BATH ROOM	5'		A			NA
68019	OUTSIDE (IN FRONT OF SHED).	5'		A			NA
68020	OUTSIDE (IN FRONT (PHOTO) OF SHED)	5'		A			NA

Location: W = Work Area, O = Outside/Perimeter

Type: G = General Area, P = Personal, A = Ambient, B = Field Blank

Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air

Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel

Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
			10		
1663	9.9	9.6	10		1/24/91
1961	10.0	9.7	10		
1668	9.9	9.6	10		
1249	9.6	9.3	10		
1682	9.7	9.4	10		
1246	9.8	9.6	10		✓

Name of Calibrator CALIBRATOR: CONNECTION CELL # 5973.H

Temp.: 70°F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust __✓ General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times 1pm \times \text{minutes} \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.327 Client: USATHAMA - TAPPAN, NY
Program Manager: B. MAESTRI Sample Location: UNIT 403
Date: 1/24/91 Shift: DAY Samples Collected by: McKISSICK / KESTONE
Collection Method: AHERA Analyze For: AIRBORE ASBESTOS (TEM)
Sample Media: 0.45-μ MCE Lot No: Nuclepore 819/004 G27 OL
UNOCCUPIED UNIT #403.

SAMPLE DATA

Sample No.	68022	68023	68024	68025	68026	68027
Pump No.	1678	1232	1669	1224	1672	1229
Time On	1158	1158	1158	1158	1158	1158
Time Off	1530	1530	1530	1530	1530	1530
Total Time (min)	212	212	212	212	212	212
Flow Rate (LPM)	9.6	9.7	9.5	9.9	10.0	9.5
Volume (liters)	2035 l	2056 l	2014 l	2099 l	1979 l ☑	1881 l ☑
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68028 FIELD BLANK

☑ Corrected for Temp differential

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68022	LIVING ROOM (SIDE WALL Between WINDOWS)	5'		A			NA
68023	KITCHEN (BY WASHER HOOK UP)			A			NA
68024	Bedroom (MASTER BR, MIDDLE)			A			NA
68025	BATHROOM (FRONT OF SINK)			A			NA
68026	OUTSIDE (KITCHEN STOOP)			A			NA
68027	OUTSIDE (FRONT OF SHED)	↓		A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1678	9.7	9.5	10.0		1/24/91
1232	9.7	9.6	10.0		
1669	9.8	9.1	10.0		
1224	9.9	9.8	10.0		
1672	9.9	10.1	10.0		
1239	9.3	9.7	10.0		

Name of Calibrator GILIAN GILIBRATOR; BUBBLE GUN, ROLL # 5977-11

Temp.: 70°F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times 1pm \times \text{minutes} \times .00785\ mm^2}$$

Batch No. 1
Page 1 of 1

UNIT 416

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA, TAPPAN, NY
Program Manager: B MAESTRI Sample Location: UNIT 416
Date: 1/24/91 Shift: DAY Samples Collected by: MCKISSICK / CESTONE
Collection Method: AIRDATA Analyze For: AIRBORNE ASBESTOS (TEM)
Sample Media: 0.45μ MCE Lot No: 819/004 G27 0L (Nucleopore)
UNOCCUPIED UNIT # 416

SAMPLE DATA

Sample No.	68029	68030	68031	68032	68033	68034	68035
Pump No.	1682	1961	1668	1248	1663	1249	FIELD BLANK
Time On	1455	1455	1455	1455	1455	1455	
Time Off	1820	1820	1820	1820	1820	1820	
Total Time (min)	205	205	205	205	205	205	
Flow Rate (LPM)	9.4	9.7	9.6	9.4	9.9	9.8	
Volume (liters)	1927	1986	1968	1927	1896 [1]	1877 [1]	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

[1] CORRECTED FOR TEMPERATURE DIFFERENTIAL

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68029	LIVING RM Between window, side	5'		A			NA
68030	KITCHEN, IN FRONT OF WATER HEATER			A			NA
68031	MASTER BEDROOM, CENTER			A			NA
68032	BATHROOM			A			NA
68033	OUTSIDE, IN FRONT OF SHED			A			NA
68034	OUTSIDE, IN FRONT OF SHED			A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1961	9.7	9.7	10.0		1/24/91
1249	9.3	10.2	10.0		"
1663	9.6	10.1	10.0		"
1668	9.6	9.6	10.0		"
1682	9.4	9.4	10.0		"
1246	9.6	9.2	10.0		✓
Name of Calibrator	CALIBRATOR: CELL # 5992-H				

Temp.: 70° F Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust __ General Area ✓ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Q_{actual} = Q_{indicated} \sqrt{\left(\frac{P_{cal.}}{P_{actual}}\right)\left(\frac{T_{actual}}{T_{cal}}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times 1pm \times \text{minutes} \times .00785\ mm^2}$$

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510,3,2	USATHAMA - TAPPAN, NY	

SAMPLERS: *(Signature)* Alton M McKissick (Printed) ALTON M MCKISSICK

PARAMETERS: NO. OF CONTAINERS; ASBA (TEM)

REMARKS: TAPPAN HOUSING UNIT #402 — UNOCCUPIED UNIT

FIELD SAMPLE NUMBER	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68015	1/25/91				LIVING ROOM	1	1	Vol = 2009
68016					KITCHEN	1	1	Vol = 2030
68017					MASTER BED ROOM	1	1	Vol = 2019
68018					BATHROOM	1	1	Vol = 1967
68019					OUTSIDE - IN FRONT of Shed	1	1	Vol = 1846
68020					OUTSIDE - IN FRONT of Shed	1	1	Vol = 1866
68021					BLANK	1	1	N/A

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/25/91	Delores Sparks			
(Printed) Alton M McKissick	Fed/EX Pick up at day end	(Printed) Delores Sparks 12:45	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68015 – 68018 FIRST. IF ONE OF THE FOUR IS > 0.005 f/cc, analyze 68019 – 68021. Need f/cc for >5μ + <5μ; TYPE of asbestos

Distribution: Original Plus One Accompanies Shipment (white and yellow), Copy to Coordinator Field Files (pink)

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510.3.1	USATHAMA – TAPIAN, NY	Y

SAMPLERS: (Signature) Alton M McKissick (Printed) Alton M McKissick

PARAMETERS: NO. OF CONTAINERS; ASBA (ITEM)

REMARKS: TAPIAN HOUSING UNIT # 403 — UNOCCUPIED UNIT

FIELD SAMPLE NUMBER	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (ITEM)	REMARKS
68022	1/24/91		1		LIVING ROOM	1	1	Vol = ~~2035 l~~ 2035 l
68023	"		1		KITCHEN	1	1	Vol = 2056 l
68024	"		1		MASTER BEDROOM	1	1	Vol = 2014 l
68025	"		1		BATHROOM	1	1	Vol = 2099 l
68026	"		1		OUTSIDE (Kitchen Stoop)	1	1	Vol = 1979 l
68027	"		1		OUTSIDE (SHED PLATFORM)	1	1	Vol = 1881 l
68028	"				BLANK	1	1	N/A

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/25/91	Delores Sparks			
(Printed) Alton M McKissick	FEB/BY PICK UP AT DAYS INN	(Printed) 1-28-91 Delores Sparks 1210	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68022 – 68025 FIRST; IF ONE OF ITEM IS > 0.005 f/cc, analyze 68026 – 68028, Need f/cc for >5μ and <5μ & TYPE OF asbestos

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510,3,2	USATHAMA - TAPPAN, NY	

SAMPLERS: *(Signature)* Alton M McKissick — (Printed) Alton M McKissick

FIELD SAMPLE NUMBER	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	PARAMETERS	REMARKS (TAPPAN Housing UNIT # 416 / UNOCCUPIED HOUSING UNIT)
68029	1/24/91		T		LIVING ROOM	1	1		Vol = 1927 l
68030					KITCHEN	1	1		Vol = 1986 l
68031					MASTER BED ROOM	1	1		Vol = 1968 l
68032					BATH ROOM	1	1		Vol = 1927 l
68033					OUTSIDE - at shed	1	1		Vol = 1896 l
68034					OUTSIDE - at shed	1	1		Vol = 1877 l
68035					BLANK	1	1		—

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/25/91	Delores Sparks			
(Printed) Alton M McKissick	FED EX PICK UP AT DAY INN	(Printed) 1-28-91 12:1?m Delores Sparks	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 68029 – 68032 FIRST. IF ANY ON IS > 0.005 f/cc, Analyse 68033 – 68035. Need f/cc for >5μ and <5μ & TYPE OF Asbestos

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Tappan, NY

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: JANUARY 31, 1991
SAMPLE RECEIPT DATE: JANUARY 23, 1991
RJ LEE GRP. JOB NUMBER: ATW-101057
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2065988	68015	UNIT #402: LIVING ROOM	2009	25	50	YES
2065989	68016	UNIT #402: KITCHEN	2030	25	50	YES
2065990	68017	UNIT #402: MASTER BEDROOM	2019	25	50	YES
2065991	68018	UNIT #402: BATHROOM	1967	25	50	YES
2065992	68019	UNIT #402: OUTSIDE - IN FRONT OF SHED	1846	25	50	YES
2065993	68020	UNIT #402: OUTSIDE - IN FRONT OF SHED	1866	25	50	YES
2065994	68021	BLANK	0	25	50	YES
2065995	68022	UNIT #403: LIVING ROOM	2035	25	50	YES
2065996	68023	UNIT #403: KITCHEN	2056	25	50	YES
2065997	68024	UNIT #403: MASTER BEDROOM	2014	25	50	YES
2065998	68025	UNIT #403: BATHROOM	2099	25	50	YES
2065999	68026	UNIT #403: OUTSIDE (KITCHEN STOOP)	1979	25	50	YES
2066000	68027	UNIT #403: OUTSIDE (SHED PLATFORM)	1881	25	50	YES
2066001	68028	BLANK	0	25	50	YES
2066002	68029	UNIT #416: LIVING ROOM	1927	25	50	YES
2066003	68030	UNIT #416: KITCHEN	1986	25	50	YES
2066004	68031	UNIT #416: MASTER BEDROOM	1968	25	50	YES
2066005	68032	UNIT #416: BATHROOM	1927	25	50	YES
2066006	68033	UNIT #416: OUTSIDE - AT SHED	1896	25	50	YES
2066007	68034	UNIT #416: OUTSIDE - AT SHED	1877	25	50	YES
2066008	68035	BLANK	0	25	50	YES

SAMPLE PREPARER

TEM OPERATOR-ANALYST

THOMAS DAGENHART, M.S.
LABORATORY MANAGER
NVLAP SIGNATORY

1-31-91
DATE

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Bartleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Tappan, NY

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6289
ATTN: PAM HILLIS

REPORT DATE: JANUARY 31, 1991
SAMPLE RECEIPT DATE: JANUARY 28, 1991
RJ LEE GRP. JOB NUMBER: ATW-101057
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER: TRACOR NORTHERN
TEM: JEOL 100 CX II

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2065988	0.0041	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2065989	0.0041	7	1.0	0.0463	1	0	1	21.58	0.004	CHRYSOTILE
2065990	0.0041	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2065991	0.0042	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2065992	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2065993	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2065994	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2065995	0.0041	7	1.0	0.0463	1	0	1	21.58	0.004	CHRYSOTILE
2065996	0.0040	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2065997	0.0041	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2065998	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2065999	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066000	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066001	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066002	0.0043	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2066003	0.0042	7	1.0	0.0463	1	0	1	21.58	0.004	CHRYSOTILE
2066004	0.0042	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2066005	0.0043	7	1.0	0.0463	0	0	0	< 21.58	< 0.004	NONE DETECTED
2066006	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066007	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066008	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED

902
903
916

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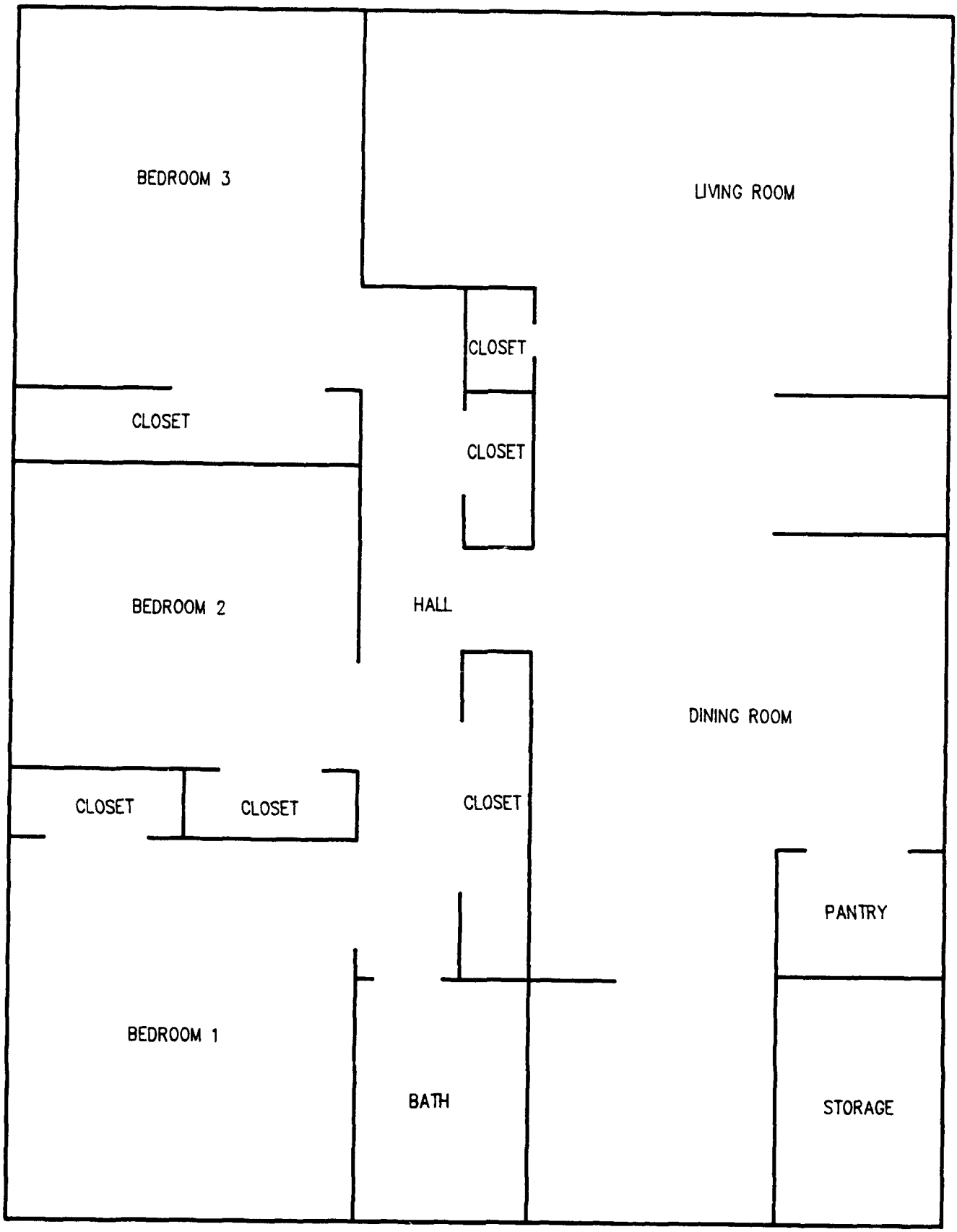
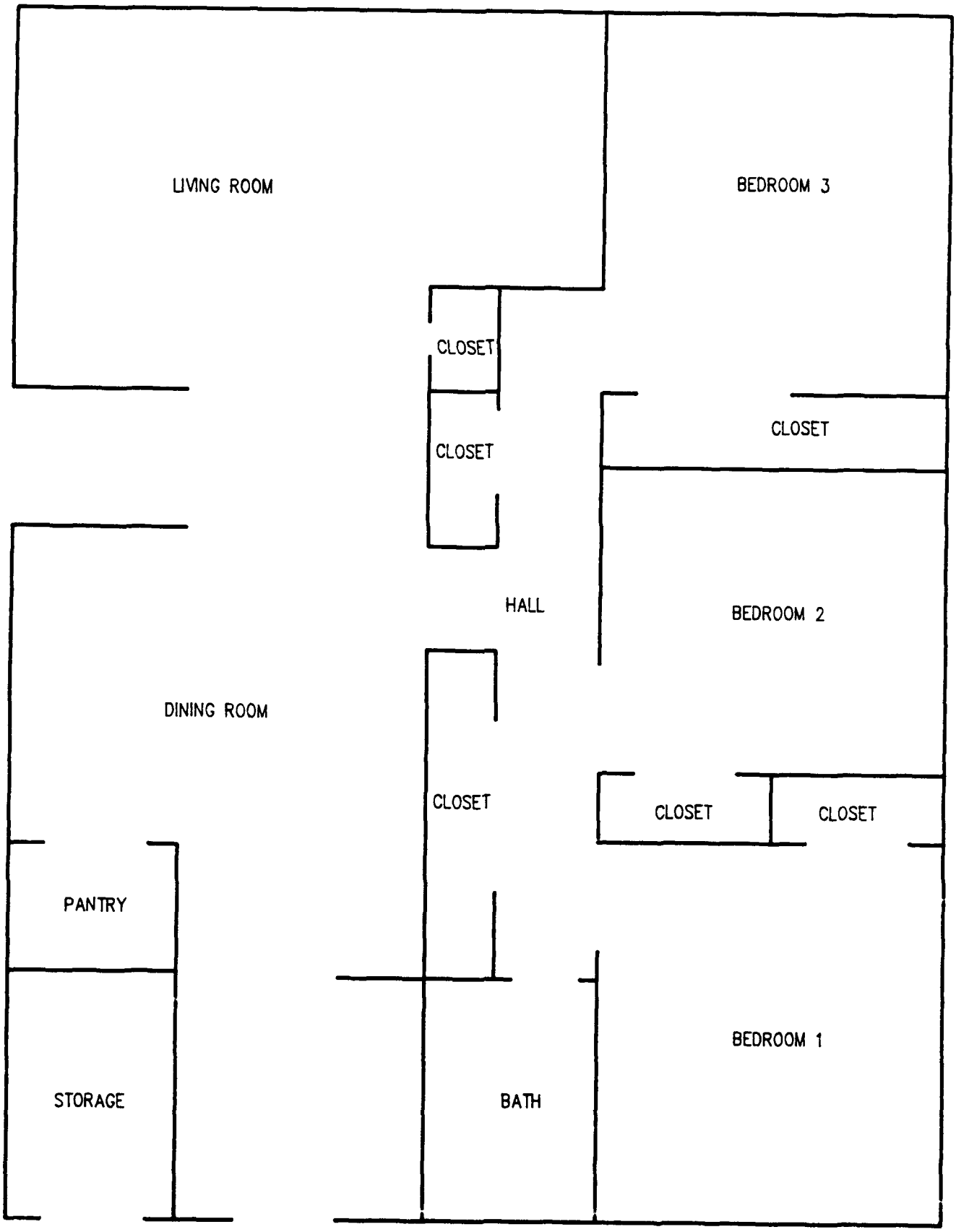
BERKELEY, CA MONROEVILLE, PA WESTERN NY

NORTH SMITHFIELD
SLATTERSVILLE, RHODE ISLAND



SLATERSVILLE FHU 1006

FLOOR PLAN



SLATERSVILLE FHU 1009

FLOOR PLAN

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA II - SMITHFIELD, RI
Program Manager: B MAESTRI Sample Location: UNIT # 1006
Date: 1/22/91 Shift: DAY Samples Collected by: McKenzie / Keystone
Collection Method: AIRFLOW Analyze For: AIRBORNE ASBESTOS
Sample Media: 0.45 µ MCE Lot No: NUCLEOPORE 819/004
OCCUPIED UNIT: SFC HAGGERTY

SAMPLE DATA

Sample No.	68008	68009	68010	68011	68012	68013	68014
Pump No.	1246	1668	1249	1961	1682	1678	FIELD BLANK
Time On	1345	1345	1345	1345	1400	1400	
Time Off	1700	1700	1700	1700	1715	1715	
Total Time (min)	195	195	195	195	195	195	
Flow Rate (LPM)	9.7	9.8	9.5	9.9	9.6	9.6	
Volume (liters)	1892	1911	1853	1931	1713	1713	
Employee Name/ID	—	—	—	—	—	—	
Results F/CC							
Fibers/Fields							
Fibers/mm²							
Detection Limit							
95% UCL							
Analyst							
QC Recounts (F/CC)							
QC Analyst							

CORRECTED FOR TEMPERATURE DIFFERENTIAL
OUTSIDE Temp = 25°F

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68008	LIVING ROOM (IN FRONT OF 3RD WINDOW)	5'		A			NA
68009	KITCHEN (ENTRANCE TO DINING ROOM)						
68010	Bedroom (6YR OLD SON'S ROOM)						
68011	BATHROOM (BESIDE SINK)						
68012	OUTSIDE; IN FRONT of GARAGE						
68013	OUTSIDE; IN FRONT of GARAGE						

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1246	9.8	9.6	10.0		1/22/91
1249	9.6	9.3			
1961	10.0	9.7			
1682	9.7	9.4			
1668	9.9	9.6			
1674	9.7	9.5	✓		✓

Name of Calibrator GILIAN GILIBRATOR; BUBBLE GENERATOR CELL # 5472H

Temp.: 70°C Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times lpm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - SMITHFIELD, RI

Program Manager: B. MAESTRI Sample Location: UNIT # 1009

Date: 1/22/91 Shift: DAY Samples Collected by: McKissick / Crestone

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: Nuclepore 819/004G270L

VACANT HOUSING UNIT # 1009

SAMPLE DATA

Sample No.	68001	68002	68003	68004	68005	68006
Pump No.	1672	1232	1669	1227	1663	1229
Time On	1240	1240	1240	1240	1240	1240
Time Off	1600	1600	1600	1600	1602	1602
Total Time (min)	200	200	200	200	202	202
Flow Rate (LPM)	10.0	9.7	9.5	9.5	9.8	9.5
Volume (liters)	2000	1940	1900	1900	*1793	*1733
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

68007 FIELD BLANK

* Corrected for Temperature Differential (15-20° F outside, snow on ground)

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
68001	Living Room (In front of BIG window)	5'		A			NA
68002	Kitchen (In front of washer/dryer hookup)	4'					
68003	Master Bedroom (center)	3'					
68004	Bath Room (By Sink)	5'					
68005	Outside; Front Door Stoop	5'					
68006	Outside; Front Door Stoop	5'		✓			✓

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1227	9.3	9.7	10.0		1/22/91
1232	9.7	9.6	"		"
1672	9.9	10.1	"		"
1663	9.9	9.6	"		"
1229	9.3	9.7	"		"
1669	9.8	9.1	✓		✓

Name of Calibrator GILIAN GILIBRATOR ; BUBBLE GEN Roll # 5972 H

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust ✓ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

NONE REQUIRED

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{\text{fibers}}{\text{fields}} - \frac{\text{fibers(blank)}}{\text{fields(blank)}} \times 385\ mm^2}{1000 \times 1pm \times \text{minutes} \times .00785\ mm^2}$$

Versar INC

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE (Y / N)
5510.3.2	USATHAMA, SMITHFIELD, RI		

SAMPLERS: *(Signature)* Alton M McKissick — *(Printed)* Alton M. McKissick

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
								HOUSING UNIT #1009 (UNOCCUPIED UNIT)
68001	1/24/91		✓		LIVING ROOM (BACK WALL)	1	1	
68002			✓		KITCHEN (AT OUTSIDE DOOR)	1	1	
68003			✓		MASTER BEDROOM (BACK WALL)	1	1	
68004			✓		OUTSIDE (FRONT DOOR STOOP)	1	1	
68005			✓		OUTSIDE (KITCHEN DOOR STOOP)	1	1	
68006			✓			1	1	
68007					BLANK (FIELD)	1	1	OPENED FOR 30 SEC
								REPORT RESULTS AS:
		AS PER			PHONE CON'V W			① f/cc for those 75% +
		TOM D,			ON 1/23/91			Those <5% (Quantify)
								② Type of asbestos

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/24/91	Connie L. Puckett			
(Printed) A. McKissick TO FED/EX AT DAYS INN, NAHANT		(Printed) Connie L. Puckett	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time
(Printed)		(Printed)	

Remarks ANALYZE 68001 - 68004 FIRST; ANALYZE 68005 - 68007 ONLY IF A CASSETTE FROM 68001 - 68004 IS ABOVE 0.005 f/cc. (VOLUME WILL BE SENT AT A LATER DATE SO CALCULATIONS CAN BE MADE)

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE (Y/N)
5510.3, 2	USA THAMA; SMITHFIELD, RI		

SAMPLERS: (Signature) (Printed)

HOUSING UNIT # 1006

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
68008	1/22/91		V		LIVING ROOM (IN FRONT OF WINDOW)	1	1	OCCUPIED UNIT
68009			V		KITCHEN (ENTRANCE TO DINING RM)	1	1	
68010			V		BED ROOM (OCCUPIED BY SON)	1	1	
68011			V		BATHROOM	1	1	
68012			V		OUTSIDE (IN FRONT OF GARAGE)	1	1	
68013			V		OUTSIDE (IN FRONT OF GARAGE)	1	1	
68014					BLANK (FIELD)	1	1	OPENED FOR 30 SEC
			AS		PER PHONE CONV			
			W		TOM D. ON			
					1/23/91			

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	1/24/91	Connie L Puckett			
(Printed) Alton M McKissick	FAXED PICK UP AT HAYS INN - NAME	(Printed) Connie C. Puckett	(Printed)		(Printed)
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by:** (Signature)	**Date / Time**	**Remarks**	
(Printed)		(Printed)			

Remarks: ANALYZE 68008 – 68011 FIRST; ANALYZE 68012 – 68014 ONLY IF A CASSETTE FROM 68008 – 68011 IS ABOVE 0.005 f/cc (WE WILL BE SENT AT A LATER DATE SO CALCULATIONS CAN BE MADE).

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

Versar INC

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA - SMITHFIELD, RI	Y / N

SAMPLERS: *(Signature)* (Printed)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS	REMARKS
68001					Vol = 2000 l			
68002					Vol = 1940 l			
68003					Vol = 1900 l		Attention: Tom D.	
68004					Vol = 1900 l			
68005					Vol = 1793 l			Corrected for Temp change
68006					Vol = 1738 l			" " " "
68008					Vol = 1892 l			
68009					Vol = 1911 l			
68010					Vol = 1853 l			
68011					Vol = 1931 l			
68012					Vol = ~~1912 l~~ 1713 l			corrected for temp change
68013					Vol = 1713 l			" " " "

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1/25/91				
(Printed) Alton M McKissick	FED/EX DAY INN NAMRT	(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
				VOLUMES FOR SAMPLES SENT FOR ANALYSES ON 1/24/91
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow), Copy to Coordinator Field Files (pink).

Smithfield, RI

RJ Lee Group

The Materials Characterization Specialists

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: JANUARY 28, 1991
SAMPLE RECEIPT DATE: JANUARY 25, 1991
RJ LEE GRP. JOB NUMBER: ATW-101050
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
65732	68001	LIVING ROOM, BACK WALL	2000	25	50	YES
65733	68002	KITCHEN, AT OUTSIDE DOOR	1940	25	50	YES
65734	68003	MASTER BEDROOM, BACK WALL	1900	25	50	YES
65735	68004	OUTSIDE, FRONT DOOR STOOP	1900	25	50	YES
65736	68005	OUTSIDE, KITCHEN DOOR STOOP	1793	25	50	YES
65737	68006	NONE GIVEN	1738	25	50	YES
65738	68007	FIELD BLANK	0	25	50	YES
65739	68008	LIVING ROOM, IN FRONT OF WINDOW	1892	25	50	YES
65740	68009	KITCHEN, INTERFACE WITH DINING ROOM	1911	25	50	YES
65741	68010	BED ROOM, OCCUPIED BY SON	1853	25	50	YES
65742	68011	BATHROOM	1931	25	50	YES
65743	68012	OUTSIDE, IN FRONT OF THE GARAGE	1713	25	50	YES
65744	68013	OUTSIDE, IN FRONT OF THE GARAGE	1713	25	50	YES
65745	68014	FIELD BLANK	0	25	50	YES

Draft 1006 Draft 1009

SAMPLE PREPARER

TEM OPERATOR-ANALYST

THOMAS DAGENHART, M.S.
LABORATORY MANAGER
NVLAP SIGNATORY

1-28-91
DATE

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Bartleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Smithfield, RI

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6743
ATTN: PAM HILLIS

REPORT DATE: JANUARY 29, 1991
SAMPLE RECEIPT DATE: JANUARY 25, 1991
RJ LEE GRP. JOB NUMBER: ATW-101050
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS

	RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
Unit 1009	65732	0.0049	6	1.0	0.0393	0	0	0	< 25.44	< 0.005	NONE DETECTED
	65733	0.0050	6	1.0	0.0393	0	0	0	< 25.44	< 0.005	NONE DETECTED
	65734	0.0044	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
	65735	0.0044	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
	65736	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
	65737	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
	65738	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
Unit 1006	65739	0.0044	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
	65740	0.0044	7	1.0	0.0459	0	0	0	< 21.81	< 0.004	NONE DETECTED
	65741	0.0045	7	1.0	0.0459	0	0	0	< 21.81	< 0.005	NONE DETECTED
	65742	0.0043	7	1.0	0.0459	1	0	1	21.81	0.004	CHRYSOTILE
	65743	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
	65744	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
	65745	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

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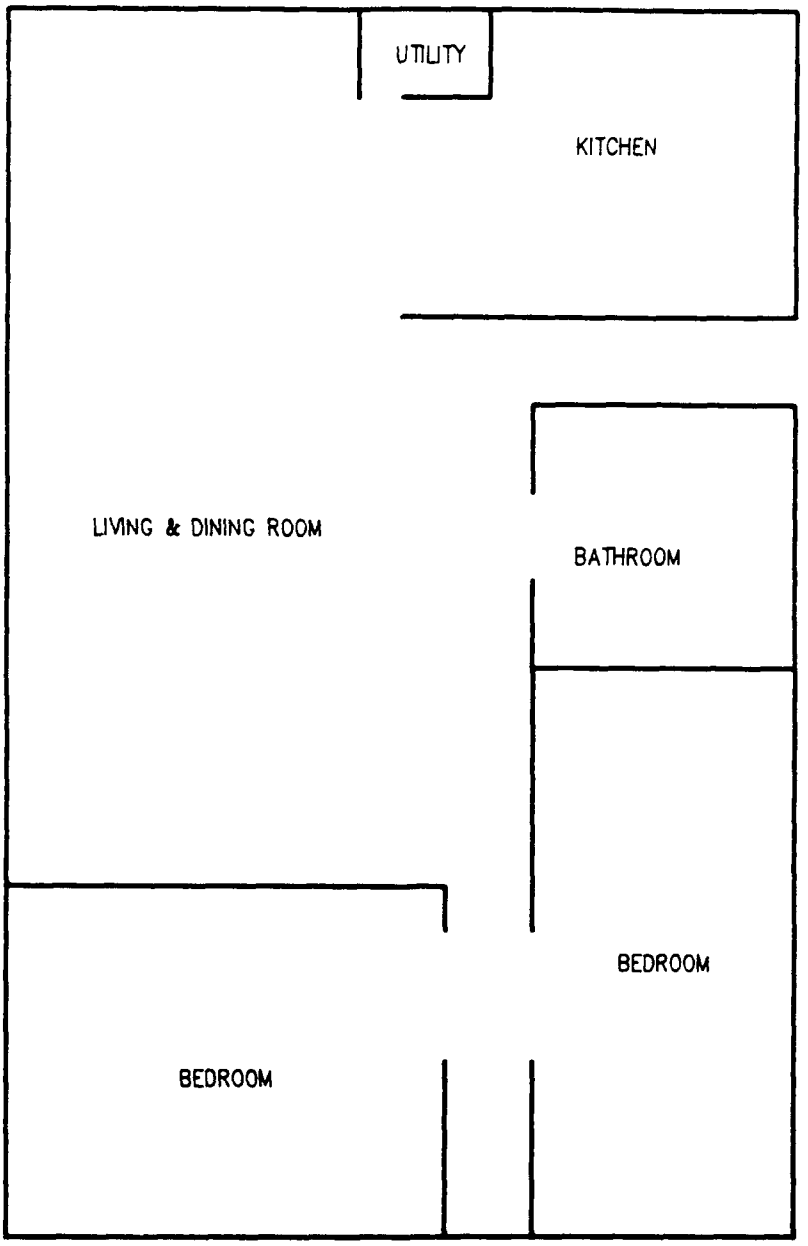
BERKELEY, CA MONROEVILLE, PA WESTERN NY

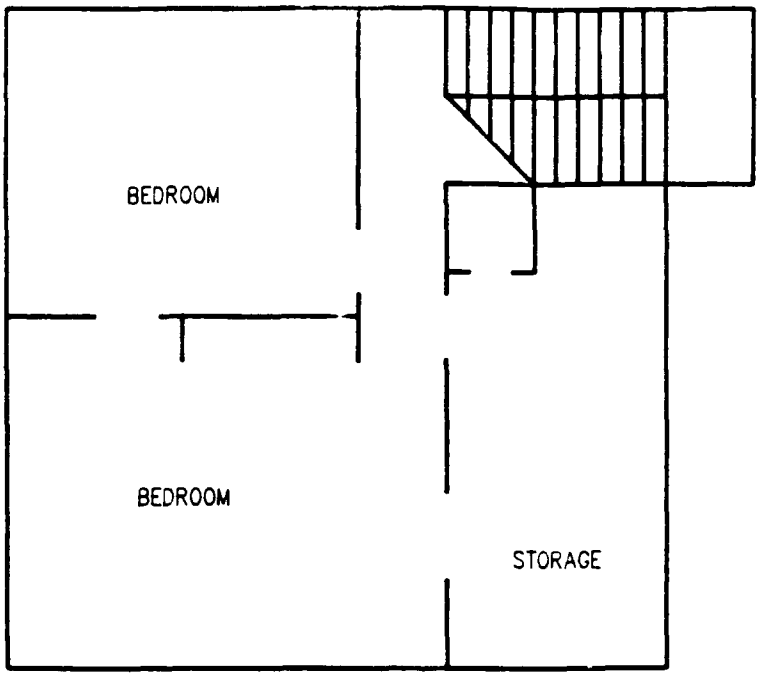
WOODBRIDGE

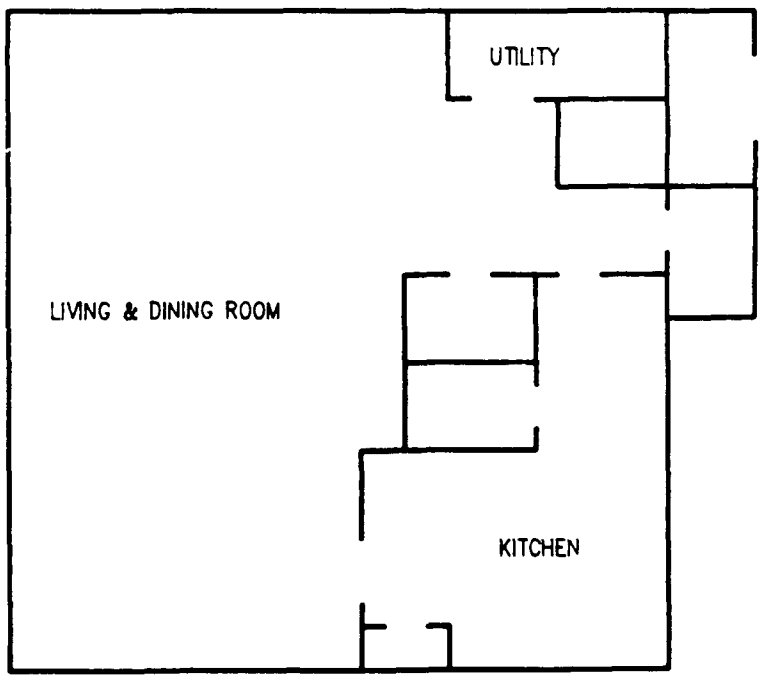
WOODBRIDGE, VIRGINIA



WOODBRIDGE FHU
FLOOR PLAN

DRAWING: D\5510\003.05\PROTO3.DWG PROJECT # 61.5510.007.05 DATE: 2/25/91





WOODBRIDGE FHU
FLOOR PLAN

DRAWING: O\5510\003.05\PROTO3.DWG PROJECT # 61.5510.007.05 DATE: 2/25/91

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USATHAMA - WOODBRIDGE VA

Program Manager: B. INABSTRI Sample Location: Duplex UNIT 14011

Date: 2/27/91 Shift: DAY Samples Collected by: A MCKISSICK/K. FOLEY

Collection Method: AHERA Analyze For: ASBESTOS (TEM)

Sample Media: 0.45μ MCE Lot No: NUCLEPORE # 914/AOUG2701

UNOCCUPIED

SAMPLE DATA

Sample No.	77133	77134	77135	77136	77137	77138
Pump No.	1664	1246	1670	1990	1228	1671
Time On	1220	1220	1220	1220	1220	1220
Time Off	1550	1550	1550	1550	1550	1550
Total Time (min)	210	210	210	210	210	210
Flow Rate (LPM)	10.5	9.8	10.0	10.0	9.9	9.7
Volume (liters)	2205	2058	2100	2100	[1] 1961	[1] 1921
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

77134 FIELD BLANK

[1] OUTSIDE TEMP = 40° F. Therefore, Volume corrected for temperature. Pumps inside screened in porch

Sample #	SAMPLE LOCATION	Height	Location	Type	Phase	Abatement	Sampling
77133	LIVING ROOM IN FRONT OF BAY WIND			A			NA
77134	KITCHEN FRONT OF SINK			A			NA
77135	BED ROOM (MASTER) CENTER			A			NA
77136	BATH ROOM BY SIDE OF SINK			A			NA
77137	OUTSIDE FRONT PORCH			A			NA
77138	OUTSIDE, FRONT PORCH			A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1664	10.2	9.7	10.0	9.5	2/27/91
1246	9.9	9.6	"	10.0	"
1670	10.1	9.8	"	10.0	"
1990	9.9	10.1	"	10.4	"
1723	9.9	9.8	"	10.0	"
1671	9.8	9.6	"	10.0	"
Name of Calibrator GILIAN		Pell # 5972-H			

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust X General Area __ None

___ Respiratory Protective Equipment Type:_____
___ Protective Clothing Type:_____
___ Gloves Type:_____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.2 Client: USA THAMA - WOODBRIDGE, VA
Program Manager: B MINSKI Sample Location: UNIT 14000 (MPF)
Date: 2/27/91 Shift: DAY Samples Collected by: A. MCKISSICK / K. FOLEY
Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS, TEM
Sample Media: NUCLEPORE Lot No: NUCLEPORE # 819/004 G270L
UNOCCUPIED

SAMPLE DATA

Sample No.	77142	77143	77144	77145	77146	77147
Pump No.	1176	1682	1230	1961	1668	1678N
Time On	1145	1145	1145	1145	1145	1145
Time Off	1515	1515	1515	1515	1515	1515
Total Time (min)	210	210	210	210	210	210
Flow Rate (LPM)	9.4	10.0	9.6	10.1	10.0	9.7
Volume (liters)	1974	2100	2016	2121	1981 [a]	1921 [a]
Employee Name/ID	—	—	—	—	—	—
Results F/CC						
Fibers/Fields						
Fibers/mm²						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

77148 FIELD BLANK

[a] INSIDE TEMP = 40° F. VOLUME IS CORRECTED FOR TEMPERATURE DIFFERENCE

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
77142	LIVING ROOM, IN FRONT OF BIG WINDOW	5'		A			NA
77143	KITCHEN, IN FRONT OF SINK			A			NA
77144	BED ROOM (MASTER) CENTER			A			NA
77145	BATH ROOM BY SIDE OF SINK			A			NA
77146	OUTSIDE BACK DOOR STOOP			A			NA
77147	OUTSIDE, BACK DOOR STOOP			A			NA

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	2/27/91
1176	9.3	9.4	10.0	10.0	"
1682	10.1	10.1	"	9.9	"
1230	9.9	9.3	"	9.5	"
1961	10.5	9.6	"	9.5	"
1668	10.0	10.0	"	10.0	"
1678N	9.7	9.7	"	10.0	"
Name of Calibrator	Gilmo Roll #		5972-14		

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust X General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
5510.3.2	USATHAMA - WOODBRIDGE, VA

SAMPLERS: *(Signature)* (Printed)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBS (TEM)	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y/N	REMARKS
77133	2/28/86				LIVING ROOM	1	1			UNOCCUPIED UNIT 14011 VOL = 2205 ℓ
77134					KITCHEN	1	1			VOL = 2058 ℓ
77135					BED ROOM	1	1			VOL = 2100 ℓ
77136					BATH ROOM	1	1			VOL = 2100 ℓ
77137					OUTSIDE	1	1			VOL = 1961 ℓ
77138					OUTSIDE	1	1			VOL = 1921 ℓ
77139	✓				BLANK	1	1			N/A

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	2/28/86 1500	Conrad F. Puckett			
(Printed) Alton M McKissick	MAIL ROOM AT VERSAR	(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 77133 - 77136 and 77139 first. If any result from 77133 - 77136 is > 0.005 f/cc analyze 77137 and 77138.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.2	USATHAMA 19 - LOCKBOURNE, OH	Y / N

SAMPLERS: *(Signature)* (Printed)

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBS (TEM)	PARAMETERS	VOLUME (Liters)	REMARKS
										UNOCCUPIED UNIT 14000 (APARTMENT)
77142	2/27/91				LIVING ROOM	1	1		1994	ON: 1145 OFF: 1515
77143					KITCHEN	1	1		2100	ON: 1145 OFF: 1515
77144					BEDROOM	1	1		2016	ON: 1145 OFF: 1515
77145					BATHROOM	1	1		2121	ON: 1145 OFF: 1515
77146					OUTSIDE	1	1		1981	ON: 1145 OFF: 1515
77147					OUTSIDE	1	1		1921	ON: 1145 OFF: 1515
77148					BLANK	1	1			BLANK

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Alton M McKissick	1500 2/28/91	Connie L Puckett			
(Printed) Alton M McKissick	MAIL ROOM @ VERSAR	(Printed) Connie L Puckett	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		ANALYZE 77142 - 77145 & 77148 FIRST. IF ANY ONE FROM 77142 - 77145 IS > 0.005 Pb/cc, ANALYZE 77147 & 77146.

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Woodbridge, VA

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: MARCH 2, 1991
SAMPLE RECEIPT DATE: MARCH 1, 1991
RJ LEE GRP. JOB NUMBER: ATW-103002
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

	RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
Unit 14011	2066865	77133	UNIT 14011, LIVING ROOM	2205	25	50	YES
	2066866	77134	UNIT 14011, KITCHEN	2058	25	50	YES
	2066867	77135	UNIT 14011, BEDROOM	2100	25	50	YES
	2066868	77136	UNIT 14011, BATHROOM	2100	25	50	YES
	2066869	77137	UNIT 14011, OUTSIDE	1961	25	50	YES
	2066870	77138	UNIT 14011, OUTSIDE	1921	25	50	YES
	2066871	77139	UNIT 14011, BLANK	0	25	50	YES
Unit 14000	2066872	77142	UNIT 14000, LIVING ROOM	1974	25	50	YES
	2066873	77143	UNIT 14000, KITCHEN	2100	25	50	YES
	2066874	77144	UNIT 14000, BEDROOM	2016	25	50	YES
	2066875	77145	UNIT 14000, BATHROOM	2121	25	50	YES
	2066876	77146	UNIT 14000, OUTSIDE	1981	25	50	YES
	2066877	77147	UNIT 14000, OUTSIDE	1921	25	50	YES
	2066878	77148	UNIT 14000, BLANK	0	25	50	YES

Monica M. McCloy
SAMPLE PREPARER

Monica M. McCloy
TEM OPERATOR-ANALYST

Tom Dagenhart 3-2-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Woodbridge VA

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM MILLIS

REPORT DATE: MARCH 2, 1991
SAMPLE RECEIPT DATE: MARCH 1, 1991
RJ LEE GRP. JOB NUMBER: ATW-103002
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER: 01-61-060536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

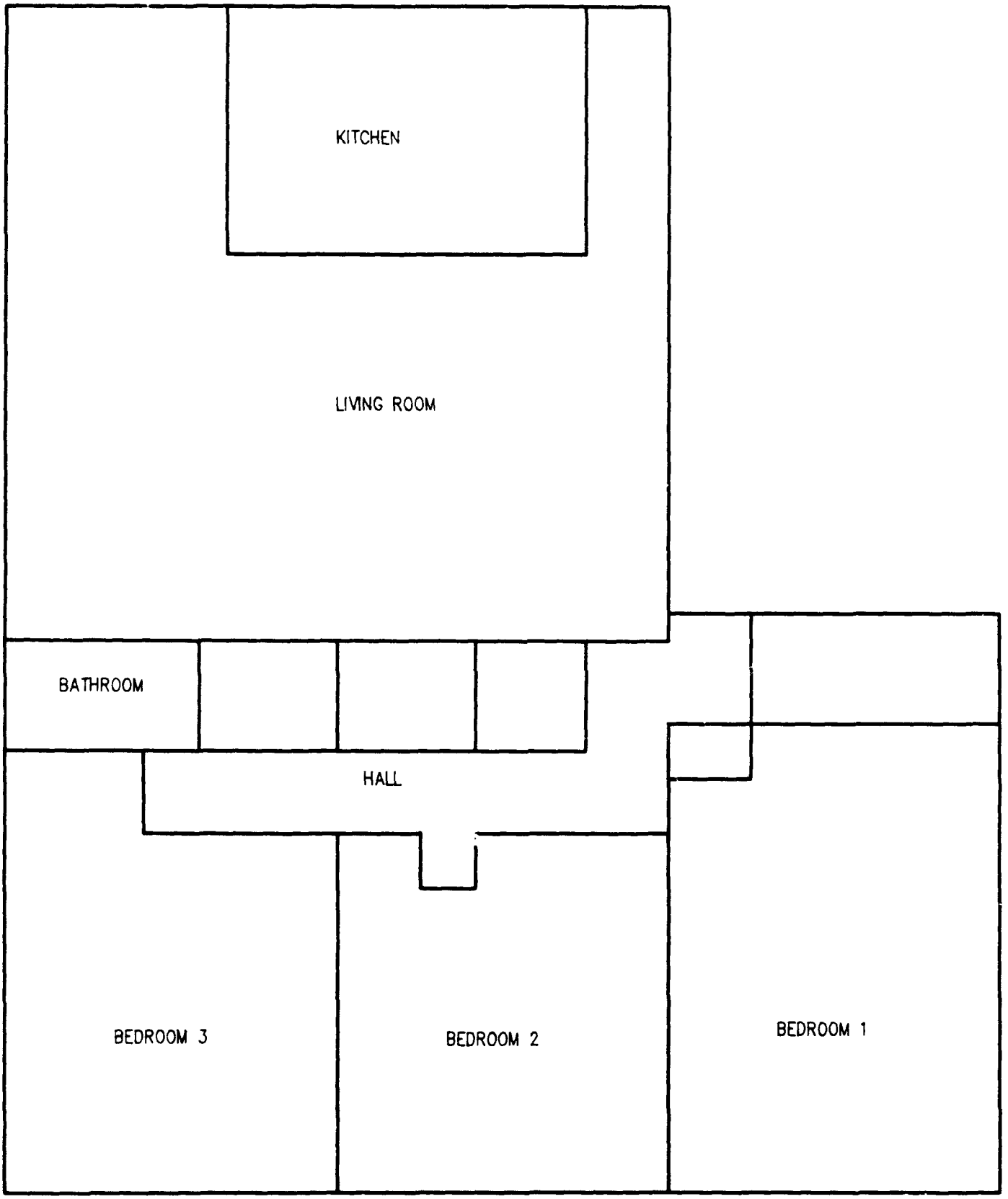
ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS
TEM: PHILIPS CM12

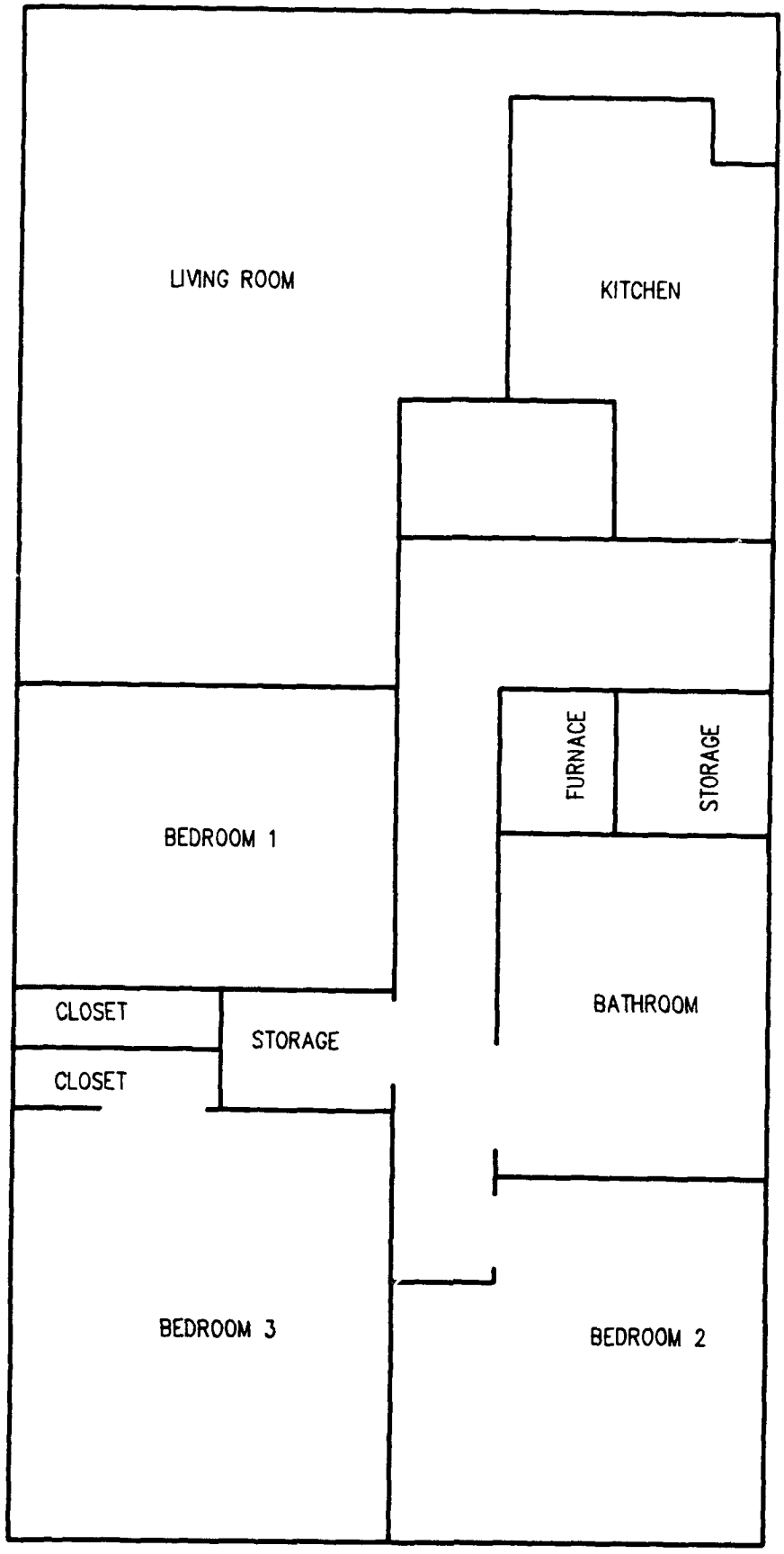
RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILU-TION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2066865	0.0044	6	1.0	0.0397	0	0	0	< 25.18	< 0.004	NONE DETECTED
2066866	0.0047	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066867	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066868	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066869	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066870	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066871	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2066872	0.0049	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066873	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066874	0.0048	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066875	0.0046	6	1.0	0.0397	0	0	0	< 25.18	< 0.005	NONE DETECTED
2066876	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066877	NOT ANALYZED	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT ANAL.	NOT ANALYZED
2066878	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

MIDWAY NIKE MANOR
KENT, WASHINGTON



MIDWAY FHU
FLOOR PLAN



MIDWAY FHU
FLOOR PLAN

DRAWING: D:\5510\003.05\FLOOR02.DWG PROJECT #: 61.5510.007.00 DATE: 2/25/91

Youngs Lake - Calibration 1-23-91

Pump No.	Pre Cal AM	Pre/Post Cal PM AM	Post Cal PM
2466	9.868	9.834 ✓	10.38 >10.1
2462	10.03	9.727 ✓	11.57 >10.65
2043	9.97	9.698 ✓	11.95 >10.72
2042	10.03	9.757 ✓	12.62 >11.119
1667	9.99	10.34 ✓	10.00 ✓
1681	9.876	10.00 ✓	9.936 ✓

Midway - Calibration 1-24-91

Pump No.	Pre Cal AM	Post/Pre Cal AM PM	Post Cal PM
2043	9.30	8.10 >8.7	8.20 ✓
2462	9.83	9.40 ✓	8.50 > 8.95
2042	9.74	9.30 ✓	9.8 > 9.55
2466	10.10	9.67 ✓	10.24 > 9.955
1681	10.00	10.10 ✓	10.04 ✓
1667	9.30	9.30 ✓	9.20 ✓

✓ = okay - within ± 5% of calibrated value - if not use average > for calculation of volume

Versar INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
61.5510.3.1	USA THAMA

SAMPLERS: (Signature) S Kryczkowski / A Olmetti (Printed) R. Kryczkowski / A. Olmetti

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: Asbestos-TEM	Flow Rate	Volume
M124-13	1-24	9:08-12:17			unit M1 Front bedroom			9.74 lpm	1256.46
M124-14	1-24	9:09-12:17			Back bedroom			10.10	1292.80
M124-15	1-24	9:09-12:16			Living room-rear window			9.83	1248.41
M124-16	1-24	9:08-12:16			Kitchen			8.7	1113.60
M124-17	1-24	9:07-12:19			Outside rear			10.10	1333.20
M124-18	1-24	9:06-10:18			Outside front			9.3	1227.60
M124-19	1-24	10:51-3:52			unit M15 Side bedroom			9.55	1728.55
M124-20	1-24	10:52-3:52			Back bedroom			9.955	1791.90
M124-21	1-24	10:50-3:51			Living room-rear window			8.95	1619.95
M124-22	1-24	10:51-3:51			Living room-front window			8.1	1458.00
M124-23	1-24	10:49-3:54			Outside-back			10.10	1868.50
M124-24	1-24	12:49-3:54			Outside-front			9.3	1720.50

INDUSTRIAL HYGIENE SAMPLE: Y / N

REMARKS

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Kasam Kryczkowski (Printed)	1-24-91 4:75p	Delores Sparks 1-25-91 (Printed) Delores Sparks 12/1	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks: - 1 Blank enclosed - use form that reports $< r > 5\mu$	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Midway, WA

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 28, 1991
RJ LEE GRP. JOB NUMBER: ATW-101056
CLIENT JOB NUMBER: 61.5510.3.1
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2065975	M-124-13	UNIT M-1: FRONT BEDROOM	1256.46	25	50	YES
2065976	M-124-14	UNIT M-1: BACK BEDROOM	1292.8	25	50	YES
2065977	M-124-15	UNIT M-1: LIVING ROOM, REAR WINDOW	1248.41	25	50	YES
2065978	M-124-16	UNIT M-1: KITCHEN	1113.6	25	50	YES
2065979	M-124-17	UNIT M-1: OUTSIDE, REAR OF HOUSE	1333.2	25	50	YES
2065980	M-124-18	UNIT M-1: OUTSIDE, FRONT OF HOUSE	1227.6	25	50	YES
2065981	M-124-19	UNIT M-18: SIDE BEDROOM	1728.55	25	50	YES
2065982	M-124-20	UNIT M-18: BACK BEDROOM	1791.9	25	50	YES
2065983	M-124-21	UNIT M-18: LIVING ROOM, REAR WINDOW	1619.95	25	50	YES
2065984	M-124-22	UNIT M-18: LIVING ROOM, FRONT WINDOW	1458	25	50	YES
2065985	M-124-23	UNIT M-18: OUTSIDE, REAR OF HOUSE	1868.5	25	50	YES
2065986	M-124-24	UNIT M-18: OUTSIDE, FRONT OF HOUSE	1720.5	25	50	YES
2065987	BLANK	FIELD BLANK	0	25	50	YES

Unit M-1

Unit M-18

JPM, RB, KD
SAMPLE PREPARER

JPM, RB, KD
TEM OPERATOR-ANALYST

Tom Dagenhart
THOMAS DAGENHART, M.S.
LABORATORY MANAGER
NVLAP SIGNATORY

1-30-91
DATE

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

RJ LeeGroup

The Materials Characterization Specialists

Money, MA

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM MILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 28, 1991
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EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

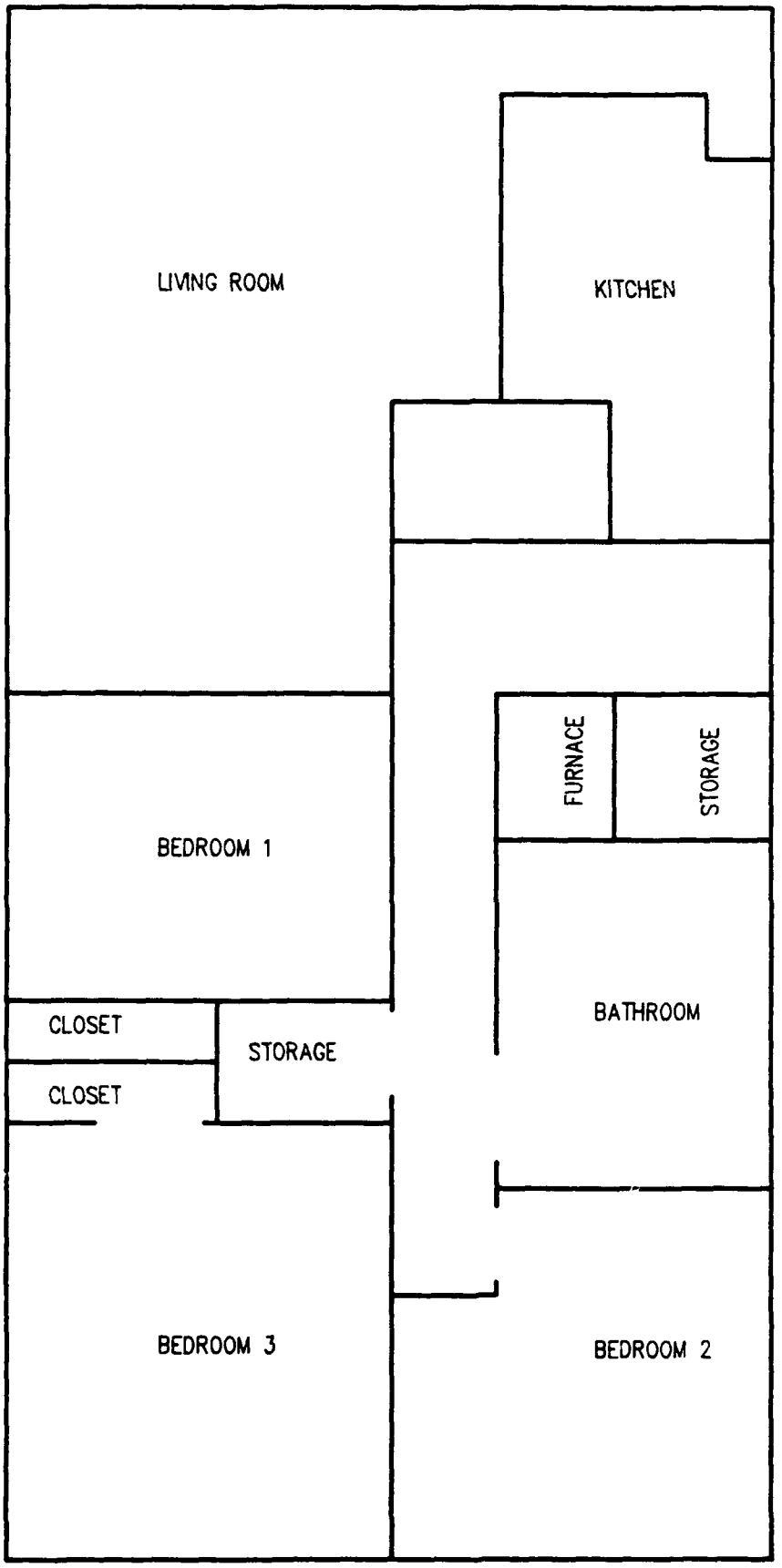
ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2065975	0.0047	10	1.0	0.0655	0	0	0	< 15.26	< 0.005	NONE DETECTED
2065976	0.0045	10	1.0	0.0655	1	0	1	15.26	0.005	CHRYSOTILE
2065977	0.0047	10	1.0	0.0655	0	0	0	< 15.26	< 0.005	NONE DETECTED
2065978	0.0048	11	1.0	0.0721	0	0	0	< 13.88	< 0.005	NONE DETECTED
2065979	0.0049	9	1.0	0.0590	1	1	2	33.92	0.010	CHRYS/ACTIN
2065980	0.0048	10	1.0	0.0655	0	0	0	< 15.26	< 0.005	NONE DETECTED
2065981	0.0042	8	1.0	0.0524	0	0	0	< 19.08	< 0.004	NONE DETECTED
2065982	0.0047	7	1.0	0.0459	0	0	0	< 21.81	< 0.005	NONE DETECTED
2065983	0.0045	8	1.0	0.0524	0	0	0	< 19.08	< 0.005	NONE DETECTED
2065984	0.0045	9	1.0	0.0590	0	0	0	< 16.96	< 0.004	NONE DETECTED
2065985	NOT APPLICABLE	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT APPL.	NOT ANALYZED
2065986	NOT APPLICABLE	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT APPL.	NOT ANALYZED
2065987	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

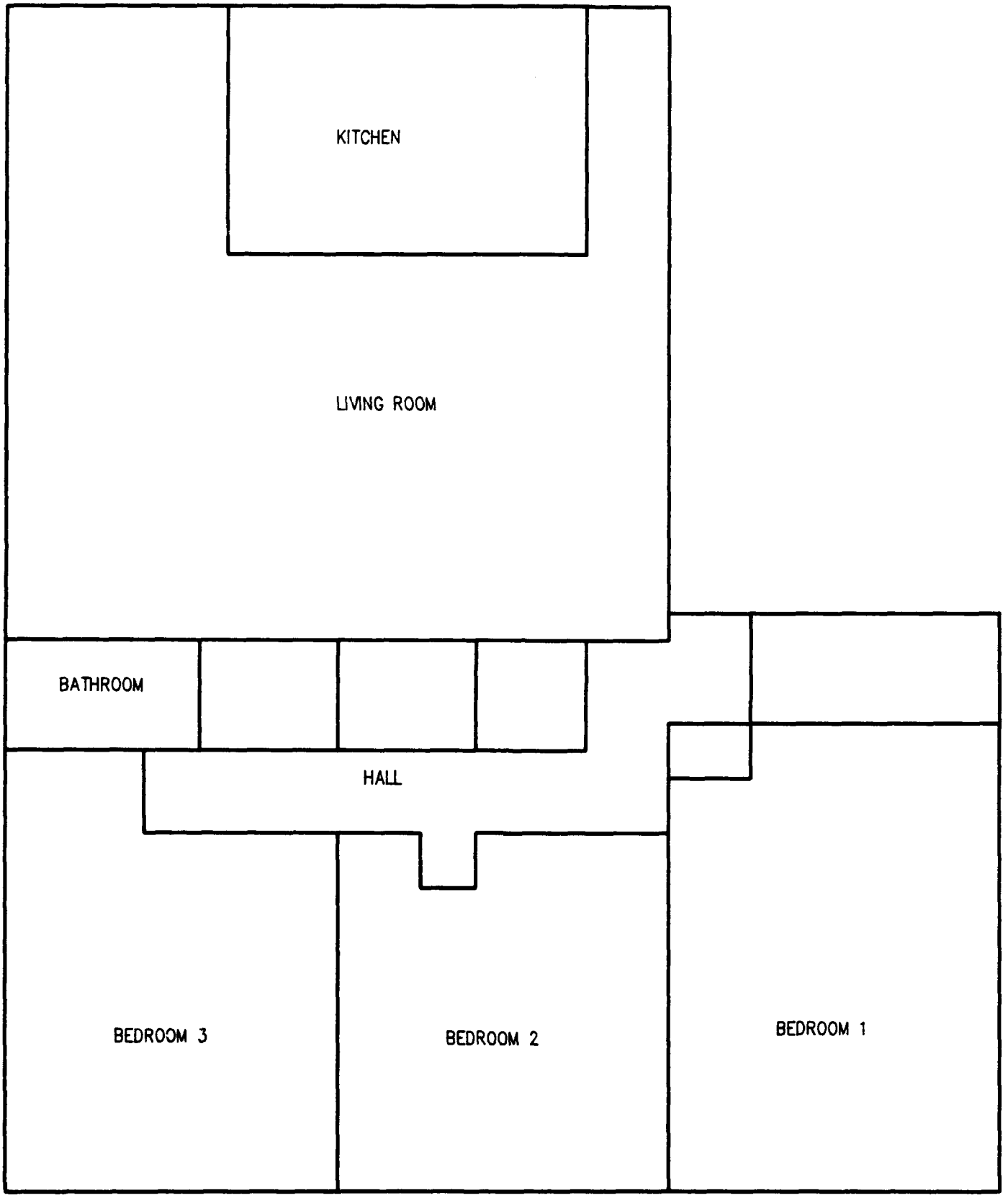
RJ Lee Group, Inc • 10366 Battleview Parkway, Manassas, VA 22110 • 703/368-7880 703/368-7761-FAX
BERKELEY, CA MONROEVILLE, PA WESTERN NY

YOUNGS LAKE
RENTON, WASHINGTON



YOUNG'S LAKE FHU

FLOOR PLAN



YOUNG'S LAKE FHU
FLOOR PLAN

Youngs Lake - Calibration 1-23-91

Pump No.	Pre Cal AM	Pre/Post Cal AM/AM	Post Cal PM
2466	9.868	9.834 ✓	10.38 >10.1
2462	10.03	9.727 ✓	11.57 >10.65
2043	9.97	9.698 ✓	11.95 >10.72
2042	10.03	9.757 ✓	12.62 >11.119
1667	9.99	10.34 ✓	10.00 ✓
1681	9.876	10.00 ✓	9.936 ✓

Midway - Calibration 1-24-91

Pump No.	Pre Cal AM	Post/Pre Cal AM/PM	Post Cal PM
2043	9.30	8.10 >8.7	8.20 ✓
2462	9.83	9.40 ✓	8.50 > 8.95
2042	9.74	9.30 ✓	9.8 > 9.55
2466	10.10	9.67 ✓	10.24 > 9.955
1681	10.00	10.10 ✓	10.04 ✓
1667	9.30	9.30 ✓	9.20 ✓

✓ = okay - within ±5% of calibrated value - if not use average > for calculation of volume

Batch No.: _____
Page 1 of 1

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.32 Client: USATHAMA

Program Manager: B. MAESTRI Sample Location: UNIT L-24 (YOUNG'S LAKE)

Date: 4/4/91 Shift: DAY Samples Collected by: MCGSICK / FOLEY

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45μ MCE Lot No: _____

SAMPLE DATA

Sample No.	77153	77154	77155	77156		
Pump No.	1232	1678N	1664	—		
Time On	1045	1045	1045	—		
Time Off	1425	1425	1425	—		
Total Time (min)	220	220	220	—		
Flow Rate (LPM)	9.9	9.8	10.2	—		
Volume (liters)	2178	2156	2244			
Employee Name/ID	—	—	—			
Results F/CC						
Fibers/Fields						
Fibers/mm^2						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
77153	FRONT BEDROOM, NEXT TO CLOSET						
77154	FRONT BEDROOM, ADJOINS ROOM FROM 77153						
77155	LIVING ROOM						
77156	BLANK, FIELD						

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1664	10.23	10.13	10.00	10.00	4/4/91
1232	9.93	9.919	10.00	10.00	↓
1678N	9.80	9.744	10.00	10.00	↓
Name of Calibrator Kevin C. Foley - Gilibrator used					

Temp.: Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust __ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value $\left(\frac{\text{upper boundry\%}}{100}\right)$
(fibers/cc) (fibers/cc)

= F/CC + F/CC $\left(\frac{213\%}{100}\right)$

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

INDUSTRIAL HYGIENE AIR SAMPLE DATA

Versar Job No.: 5510.3.4 Client: USATHAMA

Program Manager: B. MAESTRI Sample Location: UNIT L-24 (YANKEE LAKE)

Date: 4/3/91 Shift: DAY Samples Collected by: MCCISICK / FOLEY

Collection Method: AHERA Analyze For: AIRBORNE ASBESTOS

Sample Media: 0.45 μ MCE Lot No: Nucleopore 819/004G270L

SAMPLE DATA

Sample No.	77150	77151	77152	77149		
Pump No.	1232	1678N	1664	—		
Time On	1546	1546	1546	—		
Time Off	1927	1927	1927	—		
Total Time (min)	221	221	221	—		
Flow Rate (LPM)	10.0	9.8	10.4			
Volume (liters)	2210	2166	2298			
Employee Name/ID	—	—	—			
Results F/CC						
Fibers/Fields						
Fibers/mm^2						
Detection Limit						
95% UCL						
Analyst						
QC Recounts (F/CC)						
QC Analyst						

SAMPLE LOCATION

Sample #		Height	Location	Type	Phase	Abatement	Sampling
77150	Bedroom / next to closet	5'		A			NA
77151	Bedroom / opposite corner from 77150	5'		A			NA
77152	LIVING ROOM	5'		A			NA
77149	BLANK						

Location: W = Work Area, O = Outside/Perimeter
Type: G = General Area, P = Personal, A = Ambient, B = Field Blank
Phase: S = Pre-Start, E = Establish Containment, R = Removal, C = Clean, Up, F = Final Air
Abatement: FP = Fireproofing, CT = Ceiling Tiles, FT = Floor Tiles, BI = Boiler, PL = Pipe Lagging, TP = Transite Panel
Sampling: AG = Aggressive, NA = Non-aggressive

PUMP NO.	Calibration (L/min)		Rotometer Setting		Date
	Pre-Use	Post-Use	Pre-Use	Post-Use	
1232	10.07	9.91	10.00	10.0	4/3/91
1678	9.97	9.74	10.0	10.0	4/3/91
1664	10.50	10.18	10.0	10.0	4/3/91

Name of Calibrator GILABRATOR Cell # 1900-H

Temp.: 70° Pressure: RH:

PERSONAL SAMPLING INFORMATION
(Complete if collecting personal samples)

Ventilation: __ Local Exhaust __ General Area __ None

___ Respiratory Protective Equipment Type: _____
___ Protective Clothing Type: _____
___ Gloves Type: _____
___ Goggles/Face Shield
___ Ear Protection

NONE NECESSARY

Rotameter Flow Correction

$$Qactual = Qindicated \sqrt{\left(\frac{Pcal.}{Pactual}\right)\left(\frac{Tactual}{Tcal}\right)}$$

95% Upper Confidence Limit

95% UCL = measured value + measured value (upper boundry%)
(fibers/cc) (fibers/cc) 100

= F/CC + F/CC (213%)
100

QC Recounts

Difference between total number of fibers counted >2.77 x F x CV = REJECT
Difference between total number of fibers counted <2.77 x F x CV = ACCEPT
where F = average of two fiber counts
CV = relative standard deviation from intralaboratory quality control chart

Airborne Fiber Concentration

$$F/CC = \frac{\frac{fibers}{fields} - \frac{fibers(blank)}{fields(blank)} \times 385\ mm^2}{1000 \times 1pm \times minutes \times .00785\ mm^2}$$

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE (Y / N)
61.5510.3.1	USATHAMA -	

SAMPLERS: (Signature) C. Kryczkowski A. Olmetti (Printed) R. Kryczkowski / A. Olmetti

PARAMETERS: NO. OF CONTAINERS; Asbestos TEM

FIELD SAMPLE NUMBER	DATE 1991	TIME	COMP.	GRAB	STATION LOCATION	REMARKS: Flow Rate	REMARKS: Volume
Y123-01	1-23	9:22-11:58			unit L-24 Living Room - Rear Window	10.03 lpm	1564.68
Y123-02	1-23	9:24-11:58			Inside near side door	9.888	1522.75
Y123-03	1-23	9:25-11:59			Back center bedroom	10.03	1544.62
Y123-04	1-23	9:26-11:59			Front Bedroom	9.97	1535.38
Y123-05	1-23	9:35-12:05			Outside rear of house	9.876	1481.40
Y123-06	1-23	9:30 12:03			Outside - side of house	9.99	1528.47
Y123-07	1-23	12:29-3:14			unit L-19 Back corner bedroom	11.19	1846.35
Y123-08	1-23	12:30 3:11			Inside - side wall	10.10	1626.10
Y123-09	1-23	12:30-3:10			Living room - rear window	10.65	1704.00
Y123-10	1-23	12:29-3:09			Front hall	10.72	1715.20
Y123-11	1-23	12:32-3:15			Outside - side of house	10.00	1630.00
Y123-12	1-23	12:33-3:15			Outside - side of house	10.34	1675.08

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
C. Kryczkowski	1-24-91 4:45p	Delores Sparks 1-28-91			
(Printed)		(Printed) Delores Sparks 1/28/91	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				- 1 Blank enclosed - use form that reports < r > 5 µc
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Versar INC

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE (Y / N)
55193,2	USATHAMA - YOUNGS LAKE, WA		

SAMPLERS: (Signature) (Printed) A. McKissick / K. Foley

CONFIRMATION SAMPLING

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBA (TEM)	REMARKS
77149	4/3/91			✓	FIELD BLANK	1	1	UNIT L-24 OCCUPIED BY GRISOLM's
77150					FRONT Bed Room	1	1	VOL = 2210 l
77151					Front Bed Room	1	1	VOL = 2166 l
77152					Living Room	1	1	VOL = 2298 l
77153	4/4/91				FRONT Bed Room			VOL = 2178 l
77154					Front Bed Room			VOL = 2156 l
75155					LIVING ROOM			VOL = 2244 l
75156				✓	FIELD BLANK			~~VOL~~ = N/A

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Alton M McKissick	4/4/91	Fed Ex HOLIDAY Inn-Renton			
(Printed) Alton M McKissick		(Printed) Connie Pickett KJ Lee Yuen	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks USE AT LEAST 10 GRID OPENINGS
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

Younge Lake, WA

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: JANUARY 30, 1991
SAMPLE RECEIPT DATE: JANUARY 28, 1991
RJ LEE GRP. JOB NUMBER: ATW-101056
CLIENT JOB NUMBER: 61.5510.3.1
PURCHASE ORDER NUMBER: 01-61-60536

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EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2065962	Y-123-1	UNIT L-24: LIVING ROOM, REAR WINDOW	1564.68	25	50	YES
2065963	Y-123-2	UNIT L-24: INSIDE NEAR DOOR	1522.75	25	50	YES
2065964	Y-123-3	UNIT L-24: BACK CENTER BEDROOM	1544.62	25	50	YES
2065965	Y-123-4	UNIT L-24: FRONT BEDROOM	1535.38	25	50	YES
2065966	Y-123-5	UNIT L-24: OUTSIDE, REAR OF HOUSE	1481.4	25	50	YES
2065967	Y-123-6	UNIT L-24: OUTSIDE, SIDE OF HOUSE	1528.47	25	50	YES
2065968	Y-123-7	UNIT L-19: BACK CORNER BEDROOM	1846.35	25	50	YES
2065969	Y-123-8	UNIT L-19: INSIDE, SIDE WALL	1626.1	25	50	YES
2065970	Y-123-9	UNIT L-19: LIVING ROOM, REAR WINDOW	1704	25	50	YES
2065971	Y-123-10	UNIT L-19: FRONT HALL	1715.2	25	50	YES
2065972	Y-123-11	UNIT L-19: OUTSIDE, SIDE OF HOUSE	1630	25	50	YES
2065973	Y-123-12	UNIT L-19: OUTSIDE, SIDE OF HOUSE	1675.08	25	50	YES
2065974	BLANK	FIELD BLANK	0	25	50	YES

Unit L-24 Unit L-19

JPM, RB, KD
SAMPLE PREPARER

JPM, RB, KD
TEM OPERATOR-ANALYST

Tom Dagenhart 1-30-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3
PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT PAGE 1 OF 5

RJ LeeGroup

The Materials Characterization Specialists

Younge Lake, AK

LABORATORY REPORT

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6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

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ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
TEM: PHILIPS CM12
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILU-TION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2065962	0.0047	8	1.0	0.0524	0	0	0	< 19.08	< 0.005	NONE DETECTED
2065963	0.0043	9	1.0	0.0590	0	0	0	< 16.96	< 0.004	NONE DETECTED
2065964	0.0042	9	1.0	0.0590	0	0	0	< 16.96	< 0.004	NONE DETECTED
2065965	0.0043	9	1.0	0.0590	5	0	5	84.80	0.021	CHRYSOTILE
2065966	0.0044	9	1.0	0.0590	0	0	0	< 16.96	< 0.004	NONE DETECTED
2065967	0.0038	10	1.0	0.0655	0	0	0	< 15.26	< 0.004	NONE DETECTED
2065968	0.0045	7	1.0	0.0459	0	0	0	< 21.81	< 0.005	NONE DETECTED
2065969	0.0045	8	1.0	0.0524	0	0	0	< 19.08	< 0.005	NONE DETECTED
2065970	0.0043	8	1.0	0.0524	0	0	0	< 19.08	< 0.004	NONE DETECTED
2065971	0.0043	8	1.0	0.0524	0	0	0	< 19.08	< 0.004	NONE DETECTED
2065972	NOT APPLICABLE	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT APPL.	NOT ANALYZED
2065973	NOT APPLICABLE	0	1.0	0.0000	0	0	0	NOT ANAL.	NOT APPL.	NOT ANALYZED
2065974	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

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RJ Lee Group

The Materials Characterization Specialists

Youngs Lake, WA

LABORATORY REPORT

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: APRIL 8, 1991
SAMPLE RECEIPT DATE: APRIL 5, 1991
RJ LEE GRP. JOB NUMBER: ATW-104012
CLIENT JOB NUMBER: 5510.3.2
PURCHASE ORDER NUMBER:

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2067927	BI-173	UNIT L-24, (4-3-91), FIELD BLANK	0	25	50	YES
2067928	BI-173	UNIT L-24, (4-3-91), FRONT BEDROOM	2210	25	50	YES
2067929	BI-173	UNIT L-24, (4-3-91), FRONT BEDROOM	2166	25	50	YES
2067930	BI-173	UNIT L-24, (4-3-91), LIVING ROOM	2298	25	50	YES
2067931	BI-173	UNIT L-24, (4-4-91), FRONT BEDROOM	2178	25	50	YES
2067932	BI-173	UNIT L-24, (4-4-91), FRONT BEDROOM	2156	25	50	YES
2067933	BI-173	UNIT L-24, (4-4-91), LIVING ROOM	2244	25	50	YES
2067934	BI-173	UNIT L-24, (4-4-91), FIELD BLANK	0	25	50	YES

Unit L-24 4/3/91

Unit L-24 4/4/91

SAMPLE PREPARER

TEM OPERATOR-ANALYST

THOMAS DAGENHART, M.S.
LABORATORY MANAGER
NVLAP SIGNATORY

4-8-91
DATE

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

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BERKELEY, CA MONROEVILLE, PA WESTERN NY

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ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00662 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS
TEM: PHILIPS CM12

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2067927	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED
2067928	0.0026	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067929	0.0027	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067930	0.0025	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067931	0.0027	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067932	0.0027	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067933	0.0026	10	1.0	0.0662	0	0	0	< 15.11	< 0.003	NONE DETECTED
2067934	NOT APPLICABLE	10	1.0	0.0662	0	0	0	< 15.11	NOT APPL.	NONE DETECTED

4/3/91

4/4/91

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PRESCREEN CASSETTES

ECI SOIL INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE
5510.3.1	USATHAMA		Y / N

SAMPLERS: *(Signature)* Robert A. Hood

(Printed) ROBERT A. HOOD

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ASBESTOS BLANK	REMARKS
73734	1-14	11:00				1		
73733	1-14	11:00				1		
73732	1-14	11:00				1		
73731	1-14	11:00				1		
73730	1-14	11:00				1		
73729	1-14	11:00				1		
73728	1-14	11:00				1		
73727	1-14	11:00				1		
73726	1-14	11:00				1		
73725	1-14	11:00				1		
73720	1-14	11:00				1		
73724	1-14	11:00				1		

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Robert A. Hood	1-14-91 1:00 P.M.	Connie L. Puckett			
(Printed) ROBERT A. HOOD	1-14-91 1:00 P.M.	(Printed) Connie L. Puckett	(Printed)		(Printed)
Relinquished by: *(Signature)*	**Date / Time**	**Received for Laboratory by:** *(Signature)*	**Date / Time**	**Remarks**	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

ECI SOIL INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
5510.3.1	USATHAMA	Y / N

SAMPLERS: *(Signature)* Robert A. Hood (Printed) ROBERT A HOOD

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: ASBESTOS	PARAMETERS: BLANK	REMARKS
73719	1-14	11:00				1			
73723	1-14	11:00				1			
73718	1-14	11:00				1			
73722	1-14	11:00				1			
73717	1-14	11:00				1			
73721	1-14	11:00				1			
73716	1-14	11:00				1			

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Robert A. Hood	1-14-91 1:00 PM	Connie C Puckett		1-14-91	
(Printed) ROBERT A. HOOD	1-14-91 1:00 P.M.	(Printed) Connie C. Puckett	(Printed)		(Printed)
Relinquished by: *(Signature)*	**Date / Time**	**Received for Laboratory by:** *(Signature)*	**Date / Time**	**Remarks**	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

RJ LeeGroup

The Materials Characterization Specialists

LABORATORY REPORT

****

VERSAR, INC.
6850 VERSAR CENTER
SPRINGFIELD, VIRGINIA 22151
703-642-6889
ATTN: PAM HILLIS

REPORT DATE: JANUARY 17, 1991
SAMPLE RECEIPT DATE: JANUARY 14, 1991
RJ LEE GRP. JOB NUMBER: ATW-101025
CLIENT JOB NUMBER: 5510.3.1 USATHAMA
PURCHASE ORDER NUMBER: 01-61-60536

ANALYSIS: AIRBORNE ASBESTOS ON MIXED CELLULOSE ESTER FILTERS

METHOD: TRANSMISSION ELECTRON MICROSCOPY (TEM) WITH SELECTED AREA ELECTRON DIFFRACTION AND ENERGY DISPERSIVE X-RAY ANALYSIS
EPA AHERA METHOD (40 CFR 763, SUBPART E, APPENDIX A, MANDATORY METHOD)

SAMPLE INFORMATION

RJ LEE SAMPLE #	CLIENT SAMPLE #	SAMPLE LOCATION, DATE, AND/OR DESCRIPTION	AIR VOLUME (LITERS)	CASSETTE DIAMETER (MM)	COWL LENGTH (MM)	CONDUCTIVE COWL
2065471	73716	ASBESTOS BLANK	0	25	50	YES
2065472	73717	ASBESTOS BLANK	0	25	50	YES
2065473	73718	ASBESTOS BLANK	0	25	50	YES
2065474	73719	ASBESTOS BLANK	0	25	50	YES
2065475	73720	ASBESTOS BLANK	0	25	50	YES
2065476	73721	ASBESTOS BLANK	0	25	50	YES
2065477	73722	ASBESTOS BLANK	0	25	50	YES
2065478	73723	ASBESTOS BLANK	0	25	50	YES
2065479	73724	ASBESTOS BLANK	0	25	50	YES
2065480	73725	ASBESTOS BLANK	0	25	50	YES
2065481	73726	ASBESTOS BLANK	0	25	50	YES
2065482	73727	ASBESTOS BLANK	0	25	50	YES
2065483	73728	ASBESTOS BLANK	0	25	50	YES
2065484	73729	ASBESTOS BLANK	0	25	50	YES
2065485	73730	ASBESTOS BLANK	0	25	50	YES
2065486	73731	ASBESTOS BLANK	0	25	50	YES
2065487	73732	ASBESTOS BLANK	0	25	50	YES
2065488	73733	ASBESTOS BLANK	0	25	50	YES
2065489	73734	ASBESTOS BLANK	0	25	50	YES

Monica M. McCoy
SAMPLE PREPARER

CSL/gmm/mmm
TEM OPERATOR/ANALYST

Tom Dagenhart 1-17-91
THOMAS DAGENHART, M.S. DATE
LABORATORY MANAGER
NVLAP SIGNATORY

NVLAP ACCREDITATION NUMBER 1208-3

PLEASE SEE ESSENTIAL NOTES ON PAGE 3 OF REPORT

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The Materials Characterization Specialists

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ANALYTICAL INFORMATION

AREA OF GRID OPENING: 0.00655 SQ MM
DETECTION LIMIT (FIBERS PER TEN GRID OPENINGS) : 1
TEM ACCELERATING POTENTIAL: 100 KV
ENERGY DISPERSIVE X-RAY ANALYZER EDAX 9800 PLUS
TEM: PHILIPS CM12

RJ LEE SAMPLE #	ANALYTICAL SENSITIVITY (STRUCT/CC)	GRID OPENINGS SCANNED	DILUTION FACTOR	AREA ANALYZED (SQ MM)	ASBESTOS STRUCTURES DETECTED WITH ASPECT RATIO > 5 : 1, SORTED BY LENGTH >.5- <5 UM	>= 5.0 UM	TOTAL	ASBESTOS STRUCTURE DENSITY (STR/MM^2)	ASBESTOS STRUCTURE CONCENTRATION (STR/CC)	TYPE(S) OF ASBESTOS STRUCTURE DETECTED
2065471	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065472	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065473	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065474	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065475	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065476	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065477	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065478	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065479	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065480	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065481	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065482	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065483	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065484	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065485	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065486	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065487	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065488	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED
2065489	NOT APPLICABLE	10	1.0	0.0655	0	0	0	< 15.26	NOT APPL.	NONE DETECTED

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APPENDIX D
STUDENT "T" TEST EVALUATION

When an indoor air asbestos level was equal to or greater than 0.005 f/cc, which is a typical outdoor asbestos level measured by TEM in urban areas, it was necessary to determine whether an impact on the indoor air existed because of asbestos containing materials in the FHU. To determine whether an impact exists, the inside air levels were statistically compared to the outside levels using the student "t" test. The student "t" test compares a calculated value T based on the number of samples and the concentrations (non-detects were used as one-half the detection limit) to a probability distribution. The value T is calculated as follows:

$$T = \frac{\overline{y_1} - \overline{y_2}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$\overline{y_1}$ = average of log concentrations inside the work site
$\overline{y_2}$ = average of log concentrations outside the work site
$S = [(\Sigma(y_{1i}-\overline{y}_1)^2 + \Sigma(y_{2i}-\overline{y}_2)^2)/(n_1+n_2-2)]^{1/2}$
n_1 = number of samples collected inside the work site
n_2 = number of samples collected outside the work site

T is compared to the one tail, 95 percentile point of the probability distrbution with $n_1 + n_2 - 2$ degrees of freedoom. Versar collected 4 indoor samples and 2 outdoor samples; therefore, there are 4 degrees of freedom and the probability point is 2.132. If T exceeds the probability point, then the indoor levels are higher than the outside levels.

Tables D-1, D-2, D-3, and D-4 summarize the T values for Spring Valley Unit 208, Spring Valley Unit 203, Midway Unit M1, and Youngs Lake Unit L-24. As the tables show, the calculated T value for all four units are less than 2.132; therefore, the indoor levels are not statistically different from the outdoor levels.

TABLE D-1. SPRING VALLEY UNIT 208 STUDENT "T" TEST

INSIDE CONC. (F/CC)	NATURAL LOG OF INSIDE CONC.	OUTSIDE CONC. (F/CC)	NATURAL LOG OF OUTSIDE CONC.
0.002	-6.215	0.002	-6.215
0.004	-5.521	0.002	-6.215
0.004	-5.521		
0.008	-4.828		
AVERAGE	-5.521		-6.215
S=	0.490		
T=	1.633		

TABLE D-2. SPRING VALLEY UNIT 203 STUDENT "T" TEST

INSIDE CONC. (F/CC)	NATURAL LOG OF INSIDE CONC.	OUTSIDE CONC. (F/CC)	NATURAL LOG OF OUTSIDE CONC.
0.005	-5.298	0.002	-6.215
0.003	-5.991	0.002	-6.215
0.003	-5.991		
0.003	-5.991		
AVERAGE	-5.818		-6.215
S=	0.300		
T=	1.525		

TABLE D-3. MIDWAY UNIT M1 STUDENT "T" TEST

INSIDE CONC. (F/CC)	NATURAL LOG OF INSIDE CONC.	OUTSIDE CONC. (F/CC)	NATURAL LOG OF OUTSIDE CONC.
0.003	-5.991	0.010	-4.605
0.005	-5.298	0.003	-5.991
0.003	-5.991		
0.003	-5.991		
AVERAGE	-5.818		-5.298
S=	0.575		
T=	-1.044		

TABLE D-4. YOUNGS LAKE UNIT L-24 STUDENT "T" TEST

INSIDE CONC. (F/CC)	NATURAL LOG OF INSIDE CONC.	OUTSIDE CONC. (F/CC)	NATURAL LOG OF OUTSIDE CONC.
0.003	-5.991	0.002	-6.215
0.002	-6.215	0.002	-6.215
0.002	-6.215		
0.021	-3.863		
AVERAGE	-5.571		-6.215
S=	0.990		
T=	0.751		